ILLUSTRATED ELECTRICAL REVIEW

A Journal of Scientific and Electrical Progress.

VOL. 28. No. 6. WEEKLY. NEW YORK, WEDNESDAY, FEBRUARY 5, 1896. $3 PER ANNUM. Single Copies, 10 Cents.

Copyright, 1896, by Electrical Review Publishing Company, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

"Do you see that blamed Welsbach light in my show-window?" inquired a Columbus avenue shopkeeper of a customer. "Well, every night for the past week, when I have lighted it, 'click' goes the chimney and breaks. Costs me 10 cents every time that happens. Besides, every time the burner gets a sudden jar, smash goes the mantle. That costs me 50 cents. Oh, it's a great light!"

The early experiences of an electrical engineering student at Faraday House, London, are thus told by *Lightning*:

"A certain youth, X, had done very well during his first year and was in due course told to present himself at the offices of one of the chief London companies. X appeared to think that the chairman and the other members of the board would be there to meet him, so he attired himself in clothes of surpassing beauty. Strange to relate, no special meeting of the board had been called, and he was sent to the engine room. Now, if there is one thing detested in a works, it is the dude. The engineer told him to go and break up coal. X explained that he had not contemplated beginning work that day, and begged to be allowed to commence on the next. He was told to come the next morning at six o'clock. At six o'clock he turned up, in clothes that ought long since to have been given to the deserving poor. But the engineer was not yet appeased; he pointed to a broom and told X to go and sweep out a back yard.

"Now, X grasped the situation; he went and swept out that back yard and returned to his taskmaster to say he had never before realized the skill required in wielding a broom; he perceived he had still much to learn; was there not another back yard somewhere near that wanted sweeping out? X was clearly not to be drawn, so he was at once set to work in earnest.

"It is needless to say that the tale reached the manager's ears, and was told by him to the directors. X's first task did not perhaps teach him much, but the character he showed by the way he accepted the position taught every one, from the directors downwards, that they had with them a student who had the stuff in him out of which our great engineers are made. They never lost sight of him,

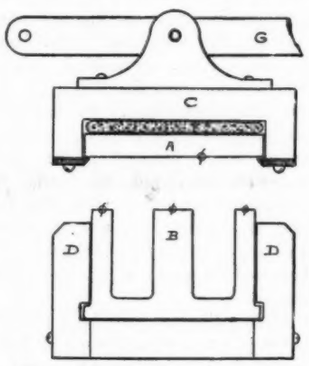


Fig. 2.—Details of a Dissectible Transformer.

and he is now on their staff and has a future before him."

"My first experience with electricity," remarked a salesman for an electrical company, "occurred when I was a clerk in a clothing store in Hartford, Ct., when arc lighting was new. We had an arc lamp in front of our store over the awning. One evening a spark of carbon dropped out of the lamp and set fire to the awning. Our porter was washing down the sidewalk with a garden hose. Rushing out I grabbed the brass nozzle on the hose, and, standing on the wet sidewalk, turned the stream on the lamp. Next thing I knew I was lying on the curbstone in close contact with a hitching post. An alarm of fire was turned in and it was with the greatest difficulty that the firemen were restrained from repeating my performance. I felt that shock for a week, and, when I got over it, determined to find out something about that wonderful force which used me so roughly. And here I am to-day selling arc-lighting apparatus."

PERSONAL.

Mr. William H. McKinlock returned to Chicago the first of last week to again take up the duties of president of the Metropolitan Electric Company, having combined business and pleasure in a two weeks' sojourn in the East.

Mr. George F. Chism, formerly with the Standard Engineering Company of Albany, N. Y., is now with Mr. LeGrand Brown, of Rochester, N. Y. Mr. Brown is making a specialty of electric railways and Mr. Chism is to devote his attention to designing electric power plants.

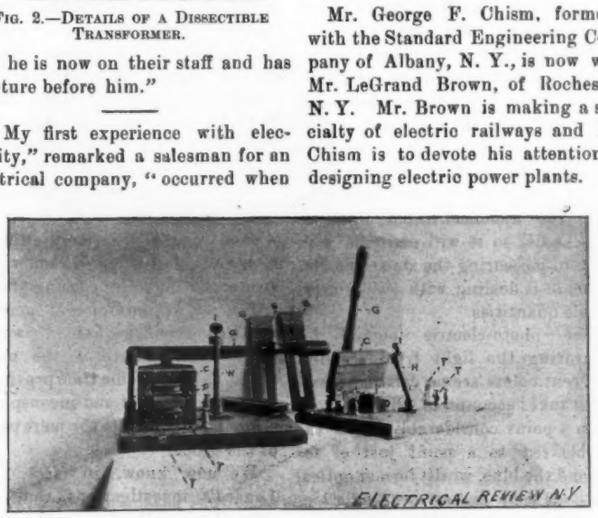


Fig. 1.—Two Dissectible Transformers.

Mr. Edward J. Hall, vice-president of the American Telephone and Telegraph Company, left New York Saturday, January 25, on a six weeks' cruise in the West Indies. Mr. William D. Sargent, of the New York & New Jersey Telephone Company, had intended to accompany Mr. Hall, but at the last moment was unable to get away on account of poor health.

A DISSECTIBLE TRANSFORMER.

BY E. W. CALDWELL.

The accompanying illustration, Fig. 1, shows two transformers so constructed that the coils may be quickly removed and changed for others of different winding. These transformers were designed by the writer for some "loud-speaking" telephone work. They have been built in several sizes at the shops of the University of Kansas and have been used there for various experimental purposes. The sizes shown in the illustration have capacities of about 75 and 150 watts, respectively, at a frequency of 125 cycles per second.

A section through one of the instruments, in a plane parallel to the laminæ of the core, is shown at Fig. 2. The two sets of iron laminæ *a* and *b*, Fig. 2, are laid up with paper in the usual way and clamped in two boxes *c* and *d*, one of which (*d*) is fastened to the base of the instrument.

A strong lever *g*, fastened to the base, supports the box *c* and enables the two parts of the core to be brought together with considerable pressure.

A movable stop *h*, with set-screw *i*, Fig. 1, engages the lever and holds the parts *c* and *d* firmly together when the transformer is in use.

The surfaces $\phi\,\phi$, Fig. 2, formed by the edges of the laminæ, are carefully planed in order to make a good magnetic joint.

A strong felt cushion *f*, Fig. 2, allows the laminæ A, when under pressure, to adjust themselves to fit any slight irregularities of the surface formed by the edges of the laminæ *b*.

The coils K K, Fig. 1, are provided with blocks of wood carrying metal strips S S, to which the ends of the wire are soldered.

Contact springs T T, provided with binding posts, are attached to the base and serve to make electrical connection with the strips S S of the coils in the transformer.

For convenience the electrical constants of each coil may be stamped upon the wooden block attached to it.

The instruments shown in Fig. 1

have three sets of contact springs so that, if desirable, three coils may be used at once.

This arrangement is useful when the transformer is substituted for the induction coil in connection with a telephone transmitter. For this purpose the well known method is to send the battery current through two of the coils, one of which is in series with the transmitter carbon and the other in shunt with it. The connections with the two coils are such that a decrease of the current in one of them, or an increase of the current in the other, will have the same magnetic effect upon the core.

ELECTRICAL NOTES.

BY R. K. DUNCAN.

MEASUREMENT OF STAR LIGHT BY SELENIUM.

Selenium is merely an elementary form of matter, one of the 70 some odd "mysteries" whose combinations form the Universe, but it possesses at least one property in such a degree as to differentiate it markedly from all other substances.

This property is, briefly, its varying electrical resistance when exposed to light of variable intensity.

In 1873, some 56 years after the discovery of the element by Berzelius, Mr. Willoughby Smith made use of a bar of "crystalline" selenium, an allotropic form of the element, as the shore-end resistance of a submarine cable which he was laying.

The resistance was found variable to a very vexatious degree and the cause remained undiscovered until during the measurement of the current the cover of the box containing the selenium happened to be removed when the galvanometer needle jumped to twice its distance. Investigation soon showed that the resistance of selenium was less when exposed to light than when immersed in darkness.

Since the discovery of this interesting fact the eye of science has been continuously on selenium as a possible aid to the investigation of many different phenomena and the perfecting of many inventions.

Thus, Bell has made use of a selenium resistance box in his photophone for the transmission of speech without wires, and we have a whole series of inventions, such as a device for the automatic turning off and on of an electric light by the increasing and the fading of daylight; an alarm which rings on the presence of a light carried, for example, by a burglar, and many others. Since the discovery of selenium's variable resistance, photoelectric cells have been devised analogous to thermo-electric cells and receiving their energy from an incident beam of light. On exposure to light an electro-motive force is developed, which produces a current, flowing from the dark to the illuminated electrode.

One of the most interesting uses to which selenium has been put is in the measurement of star light, lately achieved with marvelous exactitude by Mr. George M. Minchin. The light of a star is able to produce two effects—one photographic, the other electrical. The first is slow in its action; the other almost instantaneous. In order to obtain the electrical effect Mr. Minchin makes use of a photo-electric cell constructed in the following manner out of selenium, aluminum and the liquid ænanthol (an aldehyde obtained by the distillation of castor oil).

The end of an aluminium wire, about one millimeter in diameter, is covered with a layer of crystalline selenium by immersing it in the melted element. The selenium on the wire is then allowed to cool below the melting point and is then slowly reheated to a temperature just short of the melting point. Under these circumstances the selenium changes gradually to the gray "crystalline," or sensitive variety.

The aluminium wire is then inclosed in a tight-fitting glass tube so that the selenium end of the wire is just flush with the end of the tube. This is done to prevent the aluminium from coming into contact with the liquid ænanthol. A platinum wire then joins the other end of the aluminium wire to an electrometer and the selenium electrode of the cell is completed.

A platinum wire sealed into the bottom of the glass cell forms the other electrode.

The selenium pole of the cell is brought close up to a quartz window cemented into the side of the cell, the whole cell is filled with ænanthol and is then ready for use.

It is then placed at the focus of the telescope so that the image of the star covers the selenium electrode and the intensity of radiation is then measured by the electro-motive forces set up in the cell and conveyed to the electrometer. The sensitiveness of the cell to light is so great that an ordinary paraffine candle at a distance of nine feet will produce a deflection of 12 divisions in the electrometer. Now the light of Vega, as concentrated in the two-foot reflector used, gives a slightly greater deflection than the unconcentrated light of the candle, so it will easily be seen that, in measuring the star light, Mr. Minchin is dealing with easily measurable quantities.

The photo-electric method for measuring the light from stars of different colors seems commonsense, for it takes account of all radiations from a point considerably below the visible red to a point just as far beyond the blue, whilst former optical methods seem just as meaningless as the endeavor to equalize a blue and a red light with a "grease spot" photometer.

ON THE ELECTRIFICATION OF AIR.

At a recent meeting of the Philosophical Society, of Glasgow, Lord Kelvin presented a description of the persistent efforts he and others have made to account for the electrification of the atmosphere. So far back as 1859 he found a fair-weather difference of potential of 300 to 400 volts between the earth and an insulated burning match held nine feet above it, while during light breezes the potential rose 3,000 to 4,000 volts.

The electrification was always positive. Soon after making this observation he constructed a recording electrometer, which was placed in the Kero observatory and has been in operation ever since. It shows incessant variations of atmospheric potential, caused by variously electrified masses of air passing the point of observation.

The first attempt to explain seriously the cause of atmospheric electricity was made by McLean and Galt in 1890, who found air to be negatively electrified by a fine jet of water shot down vertically through it into a basin of water 60 centimetres below.

Their explanation was that the electrification was produced by the rush of fine drops through the air.

About the same time Lenard, working in the physical laboratories of Heidelberg and Bonn, completely destroyed the validity of this explanation and proved conclusively that the electrification was caused chiefly, if not wholly, by the drops of water impinging on the basin beneath, and, furthermore, that the electrification was greater when the water-drops struck a hard, unyielding slab of marble than when they fell upon the surface of deep water. He had been studying the high negative electrification of the atmosphere surrounding waterfalls, and he found, in accordance with this idea, that the seat of electrification was the lacerated water at the foot of the fall and the rocks against which the water dashed.

During the past year Lord Kelvin, in conjunction with Messrs. McLean and Galt, has experimented with a view to finding out whether the surface against which the water falls is the sole seat of the electrification or whether the air is not slightly electrified by the rush of water-drops through it. He found that when a stream of water was projected vertically through an iron cylinder, without touching the sides, the air was, without doubt, negatively electrified to a very slight degree, but when it struck the sides of the funnel the electrification was enormously increased.

He thus confirms Lenard's work as to the chief cause of the electrification, at the same time proving the existence of slight and inconspicuous electrification due to the mere passage of the drops.

We now know, in fact, from Lenard's investigations, that every drop of rain falling upon the surface of the earth, and every dashing waterfall, gives enormous contribution of negative electricity to the atmosphere.

But, if this is the case, why do we not find the normal electrification of the air negative instead of positive, as it actually is?

Again, we are indebted to Lenard for an apparently complete explanation. He finds that the negative electrification of air in his experiments with pure water is notably diminished by dissolving small quantities of common salt in it; that on the addition of .001 per cent the electrification is brought to zero; that over .001 per cent the electrification is positive, and that on the addition of five per cent there is a positive electrification as great in amount as the negative electrification obtained by the use of pure water. Hence seawater, containing, as it does, about three per cent of salt, must give almost as much positive electrification to the air as fresh water gives negative when equally disturbed. Lenard infers that breaking sea-waves must give positive electricity to the air and he finds, indeed, a recorded observation that on the coast of Ceylon the positive electricity of the air is notably increased by a storm at sea.

It appears then that, since the earth is two-thirds covered by the sea, breaking sea-waves may give such contributions of positive electrification to the air as to preponderate over negative electrification from fresh-water sources and so account for the normal positive electrification of the atmosphere.

ON THE DISELECTRIFICATION OF AIR.

During their work on the electrification of air, Lord Kelvin, together with Messrs. McLean and Galt, found it necessary to devise some good method by which the air could be diselectrified and the electrification conveyed to a quadrant electrometer to be measured.

The results of their work have been presented to the Royal Society.

The electric filter used by them consists of 12 disks of brass-wire cloth fixed across the mouth of a short metal tube, which is supported by pushing it into a tunnel running through a block of paraffine. The electrified air must thus pass through the paraffine and then through the wire disks before escaping. The disks are brought into metallic connection with the insulated terminal of a quadrant electrometer.

Using 12 wire disks the diselectrification is not complete, and, in order to get a filter twice as efficient, it was found necessary to use 120 disks instead of 12.

The experimenters are now engaged in endeavoring to devise a method by which they may completely diselectrify the air and measure its total electrification.

Meantime, the mere fact that the electricity of the air, whether positive or negative, may be conveyed through three or four metres of tubing and shown on a quadrant electrometer by a receiving filter is not without great interest.

The Leechburg, Pa., Electric Light Company, of which Mr. E. F. Austin is the secretary, gave its opening on Thursday night, January 30, when Morris W. Mead, of Pittsburgh, inspected the plant and passed on its acceptance. While this is not a very large plant, it comprises one 1,600-light alternating incandescent machine and one 50-light arc machine, both made by the General Electric Company. These are run by compound non condensing Dick & Church engines, built by the Phœnix Iron Works Company, of Meadville, Pa. The boilers, heater, etc., were also supplied by the same company.

New Electrical Mining Apparatus.

The operation of mining apparatus by electricity is daily growing more widespread as the steady work of the plants now running drives home the conviction that by means of electricity mines may be operated more conveniently than by any other system; better work be effected and greater economy induced. Coal and metal mine operators are animated by no sentimental inclination in favor of older methods. It is simply a question with them of an outlay and resultant profits, and the electrically driven apparatus is everywhere slowly, but effectually, displacing apparatus operated by steam or compressed air.

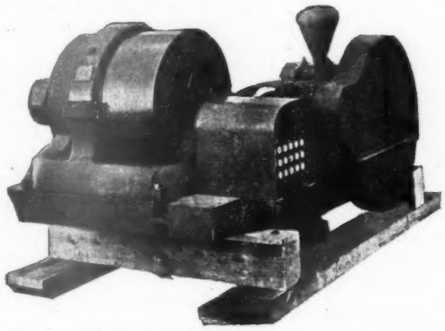


FIG. 1.—ELECTRIC MOTOR DRIVING HORIZONTAL PUMP.

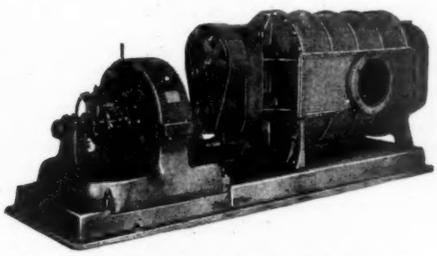


FIG. 2.—ELECTRIC MOTOR DRIVING ROOT BLOWER.

Since the General Electric Company first entered the field, it has kept steadily in view the improvement of its electrically operated mining apparatus and its adaptation to the peculiar conditions of the mining industry. The illustrations show a few examples of apparatus produced at its works and now in successful operation.

Fig. 1 shows a 6½-inch by 8-inch horizontal, triplex pump, directly driven by a 10 horse-power four-pole slow-speed motor through two reduction gears, the entire combination on the same base being mounted on a truck for ready transportation from place to place in the mine. The motor is controlled by a rheostat set at the side and, like the motor, housed in with a sheet iron cover. The illustration shows the truck mounted on wooden base for shipment.

Fig. 2 shows a No. 4 Root blower, driven by a four-pole slow-speed motor of 15 horse-power capacity and mounted on a common base frame. Fig. 3 is a 60-inch steel-plate exhaust fan, operated by a two-and-one-half horse-power four-pole motor. The fan makes 480 revolutions per minute, and has a capacity of 8,300 cubic feet of air per minute at three-quarter-ounce pressure.

The slow-speed motors driving the above mentioned apparatus are recent developments in the motor line made by the company in question and designed for use on direct-current circuits. For outputs greater than five horse-power, they present decided advantages over motors of bipolar type. They are compactly built and admit of direct combination with machinery without increasing the space occupied to any great extent. They operate at slower speed than any other motor of similar capacity yet built, and although reduction of speed must necessarily imply increase of weight, yet in this case it is amply compensated for by economy of material effected by the adoption of the four-pole type. The frames and fields are of special soft cast-steel, which, possessing high magnetic permeability, allow of the construction of a motor lighter than other motors of the same output at higher speed. The armatures are thoroughly ventilated; and the windings of copper wire, first formed and insulated, are embedded in slots in the armature core, and bound down securely on the projecting flange of the armature spider. The coils can be easily removed and replaced; the insulation is the excellent result of years of experience. The machines are sparkless, and the load can be varied from nothing to full load without the necessity of shifting the brushes. Precautions are taken to prevent any tendency on the part of the bearings to get out of alignment and proper contact of brushes with the commutator is insured by special construction of the brush holders.

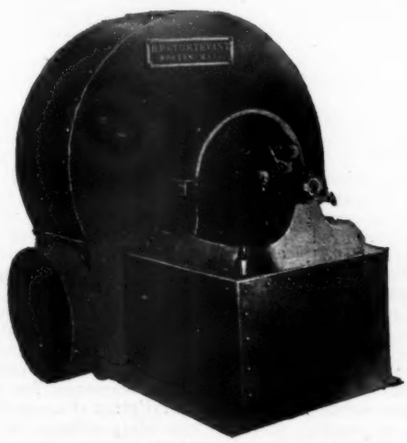


FIG. 3.—ELECTRIC MOTOR DRIVING 60-INCH EXHAUST FAN.

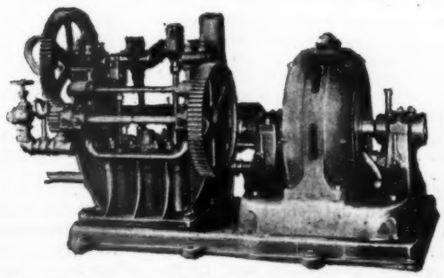


FIG. 4.—MULTIPHASE MOTOR DRIVING VERTICAL PUMP.

Another combination, introducing the multiphase motor for use on alternating-current circuits, whether monocyclic or multiphase, is shown in Fig. 4, illustrating a triplex-vertical single-acting pump, directly connected to a 220-volt 60-cycle 10 horse-power multiphase motor. This type of motor, developed by the same company, aside from its compactness, which allows of its erection in a restricted space, has the additional advantage of being absolutely without brushes, commutator or moving wires. It requires no attention and may be stopped and started under full load or no load; in fact, it has all the advantages of the best type of direct-current motor, with better regulation and without any of the disadvantages which the presence of commutators, brushes and a wire-wound armature may develop. These motors are now in use on many three-phase monocyclic power-transmission circuits in this country, operating without attention and without accident and to the entire satisfaction of the user.

TELEPHONE NEWS AND COMMENT.

The Central Union Telephone Company is reported to be making contracts at Defiance, Ohio, for three months for nothing, to head off competition.

The increase in the use of telephones throughout the United States during 1895 exceeded any previous year, and it is estimated that there was a gain of 35,000 subscribers.

A recent report states that in seven years the ratio of telephones in use in small cities in the United States has increased from 1 to every 200 population to an average of 1 to every 75 population.

Gossip among the bears in Wall street last week was to the effect that the growth of the telephone system is bound to reduce Western Union revenues to a point where five per cent dividends can not be maintained.

The New England Telegraph and Telephone Company spent about $1,000,000 for extensions last year, and the Erie Telegraph and Telephone Company spent over $600,000. During 1896 it is estimated that these two companies will spend $2,000,000 more in extensions.

The telephone aboard the stranded American liner "St. Paul" was used as a fire alarm one night last week. Men on the ship discovered a fire on shore. Frederick Reilly, who has charge of the telephone apparatus on board the vessel, lost no time in sending an alarm through the telephone to the fire headquarters in Long Branch. The fire was in a boat house, nearly opposite the ship.

During 1895 the long-distance system of the American Telephone and Telegraph Company was extended into Kentucky and Missouri. With its sub-companies the parent company is calculated to have expended between $8,000,000 and $10,000,000 in improvements and extensions. By the end of 1896 the long-distance system will have reached every important city as far west as Omaha and all between New Orleans on the south and St. Paul and Duluth on the north. Montreal and other large Canadian cities, it is reported, will soon be connected.

In regard to the expiration of the contract between Western Union and the American Bell Telephone companies in November, 1896, a prominent Bell Telephone man is reported by a financial paper as saying: "I expect that some arrangement will be made favorable to the Bell company, under which it will cease paying commissions to Western Union and perhaps receive commissions. When the deal was made the Bell company, agreed to pay Western Union 20 per cent of the rentals of total instruments outstanding. The Western Union was then in the telephone business and controlled many valuable patents, while the Bell company was young and had yet to win its spurs. Payments under this agreement began in 1881, when the Bell company paid to the Western Union company $94,000. This jumped gradually until, in 1888, the payment was $466,000 annually, and reached a maximum in 1893, when the Bell company paid to Western Union $690,000. It is estimated that in the 15 years the contract has run Bell Telephone has paid to Western Union in these commissions $6,572,000. These payments appear in the annual reports of the Bell company under the head of commissions."

ELECTRIC ELEVATORS, WITH DETAILED DESCRIPTION OF SPECIAL TYPES.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK AND CHICAGO, JANUARY 22 AND 29, 1896, BY FRANK J. SPRAGUE.

There has been so much written on the subject of electric elevators which is pertinent to the subject that in presenting this paper I shall make free compilation from others, and, supplementing these extracts with some new matter, I shall by lantern views illustrate some details of the more recent machines, their methods of manufacture and some steps in their development.

The time has passed when any one can doubt that one of the most important applications of the electric transmission of power, and one in the number and variety of its applications already rivaling the electric railway work, which has made such marvelous strides in the past eight years, is that of the operation of all classes of hoisting machinery.

Some idea of the extent of the present elevator business may be gathered from the fact that in New York city alone there are not less than 5,000 elevators of various kinds, more, in fact, than there are street cars, and more people are carried vertically than there are horizontally.

Ignoring for the moment the specific methods of application, and discounting the difficulties naturally met in developing machines to do the duty required in modern office work, not alone the technical difficulties, but those commercial ones naturally met when a new company enters the lists with untried machines against the entrenched forces of existing industries, there was still much of encouragement to be derived from a backward glance at the industrial changes wrought in the last few years, and to all objections raised there came the natural queries: Is the elevator field, great as it already is, limited to the possible application of a water or steam motor? Is there no wider, no more universal, application of power for this class of service than has hitherto been presented? Is the hydraulic elevator the one bulwark to stand up against the assaults of the electric giant? Does it present such fixity of design, unity of purpose, refinement of processes, economy of operation and freedom from accidents as to preclude improvement if using some other power?

Let us look at the record in other fields and ask: Why has the trolley system, born only eight years ago, driven the horse from the street? It involves great initial expense, the conversion, distribution and reconversion of energy. It faced all the powers of conservatism, ridicule and fear. It had to combat the allied forces of the Bell telephone interests, tested by court action in over 20 States. It had the opposition of the strongest municipal and corporate influences. Every detail of the system had to be created, and yet it stands to-day unrivaled in its industrial progress.

Why is the same trolley system driving the cable to the wall, and why has its adoption marked the abandonment of a plant costing not less than $3,000,000, in the city of Philadelphia? Are there many more examples of the direct applications of force than the cable system, many closer connections between a great engine built for the highest economy and that which it moves?

Why is the steam locomotive giving way to the electric motor on suburban service? Is there any more direct example of the application of steam than is presented by a locomotive, the power of whose cylinders is transmitted directly to the drawbar through the intermediary only of a crank?

Why does the best shop practice dictate the abandonment of the slow-speed highly-economical Corliss engine and the direct application of power by belts and shafting, and adopt the high-speed engine and direct-connected dynamo at a central station, with the conversion, distribution and reconversion of energy by a dozen different motors at a greatly increased initial expense? Is it for any other reason than convenience, reliability and economy of operation?

Why has every overhead crane builder in the United States within the past four years absolutely abandoned wire rope, square shaft and hydraulic transmission for the three-motor transmission which I advocated only nine years ago? Is it because it is simpler, because it will cost less, or because it is more economical, more flexible, and because it answers the purposes better than the other and more direct systems?

Why have the great central stations of the country adopted electricity for the transmission of power to the hundreds of industries within the radius of their supply, and into what form of energy is the power of Niagara being converted?

In short, why is the transmission of power in almost every case where flexibility, convenience, economy, efficiency and reliability are required, depending upon the electric method, not only in new work, but oftentimes to the replacing of older plants?

The elevator field, indeed, is a large one, and if the system is electric, then, considered from a commercial standpoint, there appear the following possible classes of work:

1. High-speed passenger service, where no hydraulic plant is possible because of limited space.

2. High-speed passenger service in competition with hydraulic plants, the electric plant doing equal duty, costing less, occupying less space than the hydraulic and costing much less to operate.

3. Substitution of new high-speed electric service in place of old steam and slow hydraulic services in buildings where the limited space and interference with operations will not permit consideration of a new hydraulic plant.

4. Passenger-elevator service in buildings where the loads are comparatively light.

5. Passenger service in private houses, where safety, simplicity and noiselessness are essential.

6. Freight and special classes of work.

For convenience we may classify elevator work as "first class, that requiring speeds from 300 feet to 600 feet a minute," including the first three duties above mentioned, and as "second class, those requiring speeds of from 50 feet to 250 feet a minute," which include the remainder.

In general there has been required and developed two kinds of machines to perform these services. The first is the outcome of the increased height of buildings and the demand for high speed and smooth motion, largely regardless of cost of apparatus, space occupied or cost of operation.

The hydraulic elevator was the result of this demand, and was the only one that up to a year or so ago was accepted for this service.

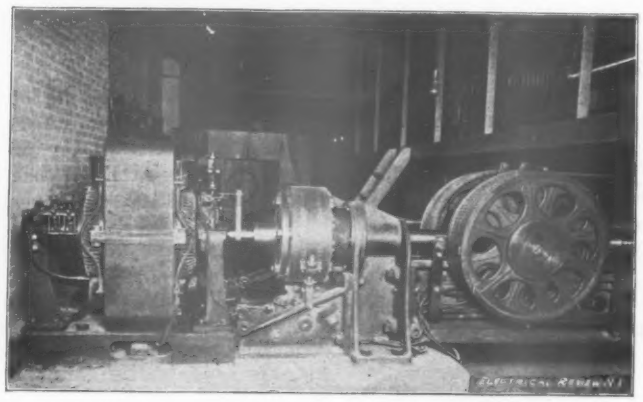
It was to meet this demand—by creating an electric elevator which would do the work equally well, if not better than the hydraulic—that the elevator to be more specifically described was developed under some unexpected difficulties.

Of course, such a machine must have the speed and capacity of the hydraulic elevator.

It must be absolutely safe.

It should have advantages in the matter of space and must be more economical to operate.

The second class of elevator work, that which requires lower speeds, is applied to small apartment houses and other buildings where lighter elevator duty is required. This for a long time has been fairly supplied by worm-gear elevators, and the replacing of the steam engine by an electric motor has enormously broadened the field for this class of machine.



OPERATING MECHANISM FOR ONE OF THE SPRAGUE ELECTRIC ELEVATORS IN THE POSTAL BUILDING, NEW YORK CITY.

These two machines, however, are not equivalents. They present two distinct kinds of rope movement, two absolutely different methods of control and two varieties of safeties.

Just here I will briefly outline some of these differences, for they constitute in my mind vital essentials and are absolutely determinate in their limitations.

The rope movement on the hydraulic is provided by an expanding set of sheaves, on which all the ropes are maintained in fixed planes. Four to six ropes can be used on the machine and six to eight on the car.

The sets of rope can be equalized at the machine, and they have a fixed lead in the hoistway.

The machines can be double and treble decked, and they have absolute limits of mechanical travel.

All of these features are of the greatest importance when dealing with high lifts, large powers and fast travel.

The drum machine, while having a distinct field of its own, and a most useful one, has not a single one of the characteristics mentioned. It can not well use over two ropes on the drum, and they can not be equalized at the machine. The lead is a shifting one, and on long lifts this may be as much as from four to five feet.

These particular objections have been met in a type of machine which may be called a cable-drum machine, where the drive is by friction of the rope in the sheave grooves; but in both these machines, the plain drum and the cable drum, there is the very grave objection that there are no fixed limits of mechanical travel which are independent of the armature movement, and on fast speeds particularly this is absolutely essential.

In the drum machines the driving power is applied through one or more worm gears.

In my own practice on light service, such as house automatic machines and a low class of freight work, I use a single gear with double-ball thrust bearings, and on heavier work a right and left handed gear, generally cut on the Hindley form, to give the fullest amount of gear surface, and with the shafts connected by independent machine-cut spur gearing, which allows the worm gears to be free from each other.

There is another distinction—that of control.

The hydraulic machine is necessarily a gravity machine, using power only in hoisting, its speed on the down side being controlled by the rate of water exit. The machine is, of course, under counter-weighted.

In the drum machine, when there is any attempt at economy, over counter-weighting is generally used, part from the car and part from the back of the drum, the over counter-weighting being approximately equal to the average load.

With these two types of apparatus as precedents, the problem was:

How far can electricity be applied? What are the limitations of control? What are the conditions of installation and operation, and to what extent could one type be eliminated?

And the answer is: Both types must be used, but for distinct classes of service.

Taking the drum type and considering electrical control on a machine overbalanced for average service, the load up or down is sometimes with and sometimes against the machine. To control such a machine directly from a supply circuit (and I can not seriously consider any other, no matter how ingenious or refined, as meeting general conditions) there is one method only, and that is the use of a rheostat in starting and the inverse variation of the strength of the shunt field for about a two to one variation in speed. A cumulative series coil is only permissible in starting if variations of speed are controllable, and in any event these variations are limited. Such a machine is, however, the best for second-class service.

Every one is familiar, of course, with the conditions of ordinary freight work. I might, however, here point out an important branch of this industry and one which is destined for very wide application, and that is automatic house service, the machine to be controlled without an operator, and so installed as to be as safe as a stairway.

Briefly, such a machine, on my system of working, is equipped with an interlocking switch device on the machine, having a co-ordinating movement with it, and with the controlling circuit in series with a number of door switches automatically opened or closed with the doors. The doors themselves are fitted with mechanical locks, allowing a car to

be opened only during a range of movement from six inches above to six inches below.

At each floor is a single controlling button. If the machine is at rest, the pressing of a button calls the car, wherever it may be, to the particular floor at which it is wanted, where it automatically stops. When the door is open it can not be started, and when running no one else can call it from the floor for which it is destined. The machine also has an additional control in the car, and the safeguards attending its operation are such as to make it safe for servant, nurse, child or invalid.

The development of the multiple-screw elevator was undertaken for the express purpose of supplanting in a large way the former standard for high-duty office service, and although not by any means an easy problem, either electrically or mechanically, a knowledge of what the hydraulic elevator is and the variation of the types existing gave adequate reasons for its attempt.

Let us consider for a moment a hydraulic system and institute a few comparisons.

It consists primarily of a steam cylinder, or a multiplicity of steam cylinders, working ordinarily under poor conditions of steam economy, that is, with a fixed cut-out in the high-pressure cylinder of a compound pump or no cut-off in any cylinder of a simple pump. This element corresponds to the cylinders of a steam engine in the electric system, which use steam expansively with a cut-off varying according to the load, and under pressure conditions which are somewhat better than exist in a pump. It is to duplicate the results of this system of variable cut-offs and steam expansion that the energies of the various pump builders have been more or less ineffectually bent for a great many years in plain acknowledgment of that defect in their simple and duplex pumps, the latter of which is common to almost every hydraulic plant of any size in the United States.

It is true that a so-called "high-duty" pump with equalizing piston is used on some of the larger elevator plants, but its use has not proved by any means entirely successful because of the spasmodic nature of the service.

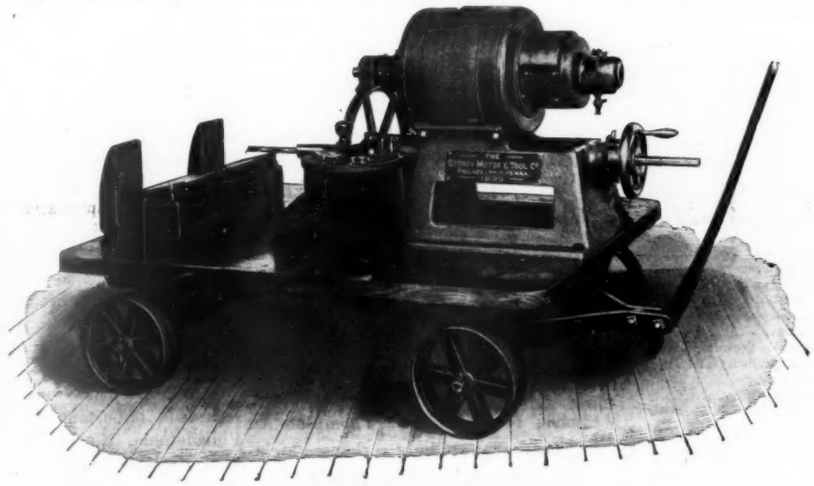
Among the high-duty pumps the flywheel type, such as is used on large water-pumping station, has been attempted, but rarely, I may fairly say, with success.

The next element is the water cylinder, which corresponds to the dynamo in the electric system, and on account of the high friction due to the packing the efficiency of a water cylinder with its valves is not ordinarily equal to that of a dynamo, which, with a motor, stands to-day the typical example of an efficient energy converter.

The next element is the piping and the tanks, compression or roof, and perhaps an accumulator, into or through which the water is pumped for delivery to the controlling valves of the elevator, and that which corresponds to this in the electric system is its simple wiring, and if a storage battery is used, then this last in conjunction with it.

Any competent engineer knows that, measured by standard practice, a given number of pounds of energy can be delivered to the controlling apparatus of an electric elevator for less pounds of steam, that is, water evaporated, through the medium of no less than fifty combinations of engines and dynamos, than can be delivered to the valves of any hydraulic cylinder through the standard pumps permissible in average elevator service. To be specific, the average water evaporation on a compound duplex pump, which is almost universally used, will in practice be not less than about 60 to 70 pounds per horse-power of water energy delivered to the controlling valves, whereas the electric combination will easily give the same for less than 40 pounds.

(To be continued.)



A Portable Electric Drill.

That Carbon Combination.

To the Editor of Electrical Review:

I noticed in your issue of the 15th instant that the carbon agreement, or combination, is now reported to be tottering.

Do you know for a fact that there is such a combination? We have been in business now for about six years, and, in justice to all carbon companies, must say that we never heard of such a combination. You speak of three different companies who have greatly disturbed this combination. I think if you would state that they have disturbed one another you would strike it nearer right.

As far as we are concerned, we have never been mixed up in any combination, nor do we know of one existing. Yours respectfully,

The Partridge Carbon Co.,
J. S. Speer, Secretary.
Sandusky, Ohio, January 24, 1896.

The engine room of the power house for the Brunswick Traction Company, at Milltown, N. J., will be 64 feet long and 85 feet wide, and the boiler room 45 feet wide and 48 feet long. The side walls are of brick and the roof trusses of iron.

A Portable Electric Drill.

The Storey Motor and Tool Company, of Philadelphia, some time ago put on the market a compact and efficient portable drill, which is illustrated herewith. This machine is adapted for drilling pig-iron and copper for test-work, drilling rails and for various other kinds of work. Owing to the type of the motor, which is entirely enclosed, it is suitable not only for indoor work, but can also be used for outside purposes without requiring any specially arranged covering for its protection. The outfit complete consists of motor and drill combined, together with regulating rheostat for obtaining any desired speed, and a drum with 100 feet of flexible cord, all mounted on a truck, with or without rack for holding material to be drilled, as desired.

These machines drill in sizes up to one and one-half inch in steel and two inches in cast-iron, and are furnished with both automatic and hand feeds.

The rapid adoption of electricity in machine shops and factories makes a tool of this kind extremely useful, as it can be moved at will wherever it is needed.

These drills can also be placed on a table or in any stationary position, and will cover a large range of work of different classes. As an illustration: Two of these drills are mounted on bed-plates, one at each end of a large callender roll, drilling two holes in flanges at the same time and tapping them in the same operation before the roll is moved. Another adaptation of this drill is where it is fitted with a telescoping shaft and is used in yards for drilling holes in the construction of switches and crossings for street-car and railroad work.

A different type of portable drill is being brought out by the above company and will be ready for the market in a few weeks.

A Receiver Appointed.

The plants of the Water, Light and Power Company, of St. Cloud, Minn., passed into the hands of C. U. Benson, as receiver, on January 22. The company defaulted in the payment of $9,000 interest upon $447,000 in bonds and $25,000 in floating indebtedness.

Annual Meeting.

The annual meeting of the Standard Underground Cable Company was held at Pittsburgh, Pa., January 28. The following gentlemen (all of Pittsburgh) were re-elected directors: George Westinghouse, Jr., Robert Pitcairn, Mark W. Watson, J. W. Dalzell, Geo. B. Hill, John B. Jackson, James H. Willock, John Moorhead, Jr., and Joseph W. Marsh.

The report of the board of directors showed a total business of nearly $1,000,000 for the year 1895. Early in the year 1895 a large building (factory C) was completed and occupied, adjacent to the company's other factories, and factory B was remodeled of first-class, slow-burning construction. The original factory, A, is a large four-story and basement building, and all three factories were equipped during the year with automatic sprinklers.

The company's branch offices are ably manned by Geo. L. Wiley, manager of eastern sales department, Times Building, New York, E. W. Dugdale, No. 336 North Broad street, Philadelphia, Pa., and J. R. Wiley, manager of western sales department, the Rookery, Chicago, Ill., at each of which places, as well as in Pittsburgh, experienced construction corps are constantly maintained for the installation of the company's products.

A Letter from Professor Marks.

To the Editor of Electrical Review:

In your issue of the 29th current I see that your printer makes me say that I am "unutterably opposed" instead of *unalterably opposed* to four directors as trustees, who interested themselves to a large extent in another company, and then used their positions as directors to try to lease their own company (the Edison) to it under a lease giving no practical protection to the stockholders. Fortunately Mayor Warwick, of Philadelia, has vetoed the vicious legislation required by the schemers, and thus prevented leasing effectually and for all time. I regret very much, indeed, that, after nine years of peaceful and friendly intercourse with my board, a sense of duty required me to take the steps that I did, and then to resign.

Respectfully,
Wm. D. Marks.
Philadelphia, Pa., January 30.

Mr. Beggs Coming to New York.

The Electrical Review is informed, on what it considers reliable authority, that Mr. John I. Beggs will terminate his connection with the Cincinnati Edison Electric Company when his present contract expires on May 15, 1896. It is further stated that Mr. Beggs will at that time come to New York city and accept a position, in an advisory capacity, with the Edison Electric Illuminating Company of New York. It is understood that Mr. Beggs's experience in Cincinnati has not been of the pleasantest nature for him and that he will be glad to get through with his work there.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 2520. NEW YORK.

EDITOR:
CHARLES W. PRICE.
ASSOCIATE EDITOR:
STEPHEN L. COLES.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

1546 "CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:
H. G. TUCKERMAN, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:
GEO. C. MAYNARD, 800 H St., N. W.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10
Back Copies, each, - - - - - - .25

SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, FEB. 5, 1896.

CONTENTS.

	PAGE
Views, News and Interviews	69
Personal	69
A Dissectible Transformer	69
Electrical Notes	70
New Electrical Mining Apparatus	71
Telephone News and Comment	71
Electric Elevators, with Detailed Description of Special Types	72
That Carbon Combination	73
A Portable Electric Drill	73
A Receiver Appointed	73
Annual Meeting	73
A Letter from Professor Marks	73
Mr. Beggs Coming to New York	73
Roentgen's "X Rays"	74
Keep Your Carbons Dry	74
Cost of Calcium Carbide	74
Wall Street and the Electrical Stock Market	74
Photographs by "X Rays."	75
The Arnold Electric Power Station System	76
Pertinent Observations—IV	77
Our Boston Letter	78
Bell Telephone Output	78
Trolley Work on Long Island	78
A Comprehensive Calendar	78
Electric Railway Progress in Northern Ohio	78
Advance Information	79
The New Haven Car Registers Triumphant at Atlanta	79
Literary	80
Our Canadian Letter	80
Kind Words	80
Kindred Interests	ix
Russian Thistles for Fuel	ix
The Columbia Incandescent Lamp Company	ix
New York Electrical Society	ix
A Taylor Battery Found	ix
Electrical Patents	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE
Abendroth & Root Mfg. Co., boilers	xvi
American Electrical Works, insulated wire	i
Akron Insulator and Marble Co., "Standard" electrical wire tubes	xv
Armington & Sims, engines	xvi
Beacon Lamp Co., incandescent lamps	i
Bishop Gutta Percha Co.	xvi
Bristol Co., voltmeters and ammeters	i
Bunnell & Co., J. H., dry batteries	i
Columbia Incandescent Lamp Co	i
Day's Kerite, insulated wire	i, x
Electric Appliance Co., supplies	i
Fort Wayne Electric Corporation, "Wood" apparatus	ii
Goubert Manufacturing Co., heaters	xv
Hampson, E. P., & Co., engines	xvi
Hano, Phillip, & Co., modern methods	xv
Interior Conduit and Insulation Co., Lundell dynamos and motors	i
Lombard Water-Wheel Governor Co	xvi
McKenney & Waterbury, electric light fixtures	i
Okonite Co., insulated wire	i, xvi
Partridge Carbon Company, motor and generator brushes	i
Roebling's, John A., Sons Co	xvi
Safety Insulated Wire and Cable Co	i
Stewart, F. H., & Co., knife switches	i
Stirling Co., water tube boilers	xvi
U. S. Mineral Wool Co., copper caskets	i
U. S. Telephone Construction Co., "M. & B." telephones	i

INSIDE PAGES.

Adams-Bagnall Electric Co., arc and incandescent lamps	xi
Addystone Pipe and Steel Co	ix
American Bell Telephone Co	xiii
American Electric Telephone Co., long-distant telephones	xii
Baker & Co., platinum	xiv
Ball & Wood Co., engines	v
Baxter, H. E., & Co., electrical supplies	viii
Brady, T. H., Brady mast-arms	xiii
Brill, J. G., Co., railway cars	viii
Brixey, W. R., Day's kerite wires and cables	viii
Buckeye Electric Co., incandescent lamps	iii
Cameron, A	80
Central Electric Co., Pharos incandescent lamps	iii
Connecticut Telephone and Electric Co	xiii
Consolidated Telegraph and News Co	xiii
Correspondence School of Technology	ix
Dickinson Electric Supply Co., sign lamps	80
Dixon, Jos., Crucible Co., belt dressing	xiii
Duval, E. S., Jr., patents	x
Dyer & Driscoll, patent solicitors	x
Eddy Electric Mfg. Co., Eddy generators	xi
Empire China Works, porcelain specialties	xiv
Eppenger & Russell Co., Valentine subway electrical conduit	xiii
Faraday Carbon Co., carbons	iv
Fleming, W. H., woven wire dynamo brushes	xiv
Garvin Machine Co	v
Gates Electric Mfg. Co	iii
General Electric Co., electric light supplies	vi
Globe Electric Light Co., incandescent lamps	v
Gordon-Burnham Battery Co	iv
Harrisburg Foundry & Machine Co., Harrisburg ideal engines	iii
Homer, F. E., & Co., commutators	xiv
Hooven, Owens & Rentschler Co., electric railway and electric light engines	iii
Huebel & Manger, bells, push buttons, etc	ix
Independent Electric Co., fuse wire	80
International Correspondence Schools	x
Jewell Belting Co	xi
Keystone Telephone Co	xii
Leffel, Jas., & Co, water wheels	vi
Lehigh Valley Creosoting Co., creosoted lumber	ix
Manhattan Electrical Supply Co., Mesco battery	ix
Mansfield, Wallace H., second-hand machinery	ix
Mason-Maxwell Telephone Mfg. Co	xii
Marshall, Wm., condensers	ix
McEvoy, C. H., telephone and switchboard cards	xii
McIntire, C., Co., The, connectors and terminals	80
Morris, Tasker & Co., tubes, poles, etc	vii
Metropolitan Electric Co., supplies	xii
Metropolitan Telephone and Telegraph Co	xiii
McLeod, Ward & Co	x
Mianus Electric Co., telephones and electric supplies	xiii
Moore, Alfred F., insulated electric wire	xiii
National Electrical Exposition Co	vii
New England Engineering Co	xi
New York Insulated Wire Co	v
New York Belting and Packing Co., rubber belts	xiv
Ostrander, W. R., & Co., supplies	x
Pacific Electric Co., electric water heaters	80
Partrick & Carter Co., electrical supplies for housework	ix
Pemsel, F., Nürnberg, machines and complete installations	vi
Penn Mutual Life Co	vii
Phillips Insulated Wire Co., wire	ix
Proposals for Lighting City of Keokuk, Iowa	80
Quaker City Electric Co., dynamos and motors	iv
Read, Robt. H., patents	x
Replogle Governor Works	vi
Rodrigues, M. R., premier baby	v
Rhode Island Tool Co	iv
Royal Electric Co., alternators	ix
Royce & Marean, electrical supplies	ix
Safety Car Heating and Lighting Co	vi
Schoonmaker, A. O., India mica	ix
Scientific Machinist Co	ix
Scott Electric Lamp Co	v
Siemens & Halske Electric Co., generators and motors	vii
S. K. C. Specialty Co	xiv
Solar Carbon and Mfg. Co., carbon specialties	xiv
Standard Air-Brake Co	viii
Standard Thermometer Co., arc lamps	vi
Stanley Electric Manufacturing Co	iv
Syracuse Storage Battery Co	vii
"Wanted."	80
Warren, A. K., & Co	vi
Western Electric Co., supplies	xiv
Western Telephone Construction Co., telephones	xii
Westinghouse Electric & Mfg. Co	v
Weston Electrical Instrument Co., measuring instruments	viii
White-Crosby Co., contracting engineers	x
Whitney Electrical Instrument Co	ix
Williams Mfg. Co., tanks	vi
Wyckoff, Seamans & Benedict, "Remington" 6	x

Our readers will notice that we have changed the color of the ink on the cover of the ELECTRICAL REVIEW from blue to black. We have tried blue, bronze blue and crimson inks on the cover, and have finally decided that nothing is so satisfactory or lasting in its qualities as a good black ink, which is what we shall use hereafter.

ROENTGEN'S "X RAYS."

While there is an abundance of reliable scientific opinion on Professor Roentgen's new experiments in photographing through opaque substances, the daily press is full of praise for the "new discovery," and long accounts of its wonderful possibilities are cabled from the other side. It is probable that Roentgen has taken up Heinrich Hertz's and Lenard's investigations and carried them a step further.

The Hertzian wave has a greater length than light or heat waves and also possesses the power of penetrating certain thicknesses of certain opaque substances. It is with the "X rays" emitted from a Crooke's tube, that the experiments by Roentgen and his American contemporaries have been made. The results achieved have been remarkable and an interesting account of them is given on another page.

Professor Roentgen does not claim as his discovery the fact that opaque bodies are transparent to the light emitted from Crooke's tubes. Hertz demonstrated about four years ago that cathode rays generated by an electrical discharge through a rarefied gas would pass through metallic films and produce optical effects beyond them. Further developments in this line will be awaited with interest.

KEEP YOUR CARBONS DRY.

There was once a well known maxim about the desirability of keeping one's powder dry. It now seems it is just as important to keep carbons dry. From tests and investigations made by Prof. S. P. Thompson it appears that arc light carbons, which after thorough drying gave a very satisfactory curve of burning, while damp showed extremely irregular results. Carbons are not always stored in the driest place possible, and as they have quite a considerable hygroscopic capacity, it is not improbable that some of the irregularities attributed to defective manufacture of the carbon or improper construction or operation of the lamp may be due to simple dampness.

COST OF CALCIUM CARBIDE.

The cost of calcium carbide is a matter of present dispute in connection with the current interest in acetylene gas. Our esteemed contemporary, the *Engineering and Mining Journal*, which has done good work on this question, learns from Paris that the price of calcium carbide in that city is nine cents a pound, or $180 per ton, and that no money has been spared in trying to cheapen the cost of production. There is quite a difference between these figures and those of Mr. John C. McMynn, who says he saw two tons of calcium carbide produced at Spray, N. C., at a cost of $25 a ton.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

The financial event of the week was the formation of an anthracite coal pool to be operative at least until January 1, 1897. Percentages are apportioned to each of the 11 interests. If it holds together, and the probabilities are that it will, it means a net increase in revenues for 1896, as compared with 1895, of at least $20,000,000. It will remove a weight of uncertainty from the general market and relieve the pressing necessities of some of the weaker coal roads.

The outside public were not induced to take hold of the market, despite its rather sharp advance under manipulation. Operators took all stock offered, a part of which was from interests who bought at low prices during the panic, and at the close appeared to have a capacity for more. About midweek a reaction was expected. The fact that it did not occur is attributed to the formation of the coal pool. Saturday night the list had the appearance of being over bought and reactionists were quite positive in asserting their views. Sterling exchange is now below the specie point, owing to the making of large sterling loans, and gold exports are over for the time being. The volume of general business has been curtailed through uncertainties arising from the bond subscriptions, being reflected in a decrease of 6½ per cent as compared with the corresponding week of last year. Prices of most staples have been firm and the advance in cereals has created a little better feeling in the West. If it continues, it is destined to bring about important trade developments.

Electrical stocks were strong and recorded important changes. In Philadelphia, Electric Storage common advanced from 25⅞ to 31 and the preferred from 27 to 35. General Electric was the great feature in Boston and New York. The advance was from 27 early in the week to 31 on Saturday, with a close at 30½. The volume of transactions was large and was undoubtedly based upon knowledge of a showing for the year and of important contracts that are pending. I am creditably informed that it is now only a matter of a few days, possibly before the ELECTRICAL REVIEW goes to press, before a contract between Manhattan and General Electric, for very important equipment, will be signed. Aside from this feature, the stock is inviting at these prices, owing to the fact that the company has assets that are sufficient to discharge all obligations, including both classes of stock and the bonds at market quotations, and leave a surplus in the form of real estate and equipment.

An important statement, if true, comes from Boston in effect that the General Electric Company has canceled the $1,250,000 of bonds that it bought in 1895. The total issue outstanding, January 1, 1895, was $8,900,000. A cancellation of 14.04 per cent of the issue, it would seem,

must enhance the value of the bonds outstanding. The quotation on the bonds this week was 86½@86¾.

The advance on the preferred stock was from 54 on Monday to 58½ on Saturday. The movement was in sympathy with the advance in the stock. A movement headed by Mr. Samuel C. Carr, one of the trustees of the Ames estate, to ascertain why the interest on the preferred stock, now amounting to 17½ per cent, had not been paid, and what the company proposes to do in the matter, is reaching a head. The amount involved is $744,100.

Edison Electric Illuminating of New York sold at 95. The recovery from the low of the panic has been about 8 points. It is natural, in view of the excellent showing made in the annual report.

I am told that the move now under way to equip the horse roads of the Metropolitan system in this city has been more potent in stirring the Manhattan Elevated Company to action than all the protests of the public since the various lines were consolidated under the present management.

I am reliably informed that the Electric Storage Battery Company, of Philadelphia, has made a contract with the Manhattan Elevated road to commence, within two months, experiments with a storage battery car on the Thirty-fourth street branch of the Third avenue line. This company will equip a car with batteries to supply power, light and heat, and the General Electric Company will furnish the motors and the plant to generate current with which to charge the batteries.

It is the opinion in Wall street that a comprehensive arrangement had about been concluded with the General Electric Company to equip all the elevated roads in New York on the third-rail system when Russell Sage kicked over the traces and made a successful objection. It is the belief that only Russell Sage's decease will permit the equipping of all these lines with the third-rail system, and that the General Electric Company will get the contract.

There has been a lot of talk of late of a consolidation between the Metropolitan Traction and the Manhattan Elevated. This can be put down as "rot" and attributed to a motive to favorably influence the price of the elevated stock. However, I understand that there is an agreement between the two systems to fight underground transit. The Traction people recognize that in so doing they are virtually working for the extension of the Manhattan line, but expect to derive benefit through a development of the uptown section of the city as well as by keeping competition out of the field. A case in point is the success of the Columbus avenue line, which would not have been possible before the elevated built up that section of the city.

On the Boston Exchange, movements in addition to those chronicled were as follows: Bell Telephone advanced 2½ to 200, Erie Telephone gained 1½ to 62, and New England Telephone 1½ to 89. Westinghouse common was 30@30½, and the preferred 53@53½. BAIN.

New York, February 1, 1896.

PHOTOGRAPHS BY "X RAYS."

PROFESSOR ROENTGEN'S RECENT EXPERIMENTS ARE BEING VERIFIED BY A NUMBER OF AMERICAN SCIENTISTS.

No better recent example of the characteristic American spirit—energetic and intelligent "hustling"—has been shown than was exhibited last week by a number of our scientists, who immediately began experiments to confirm the announcement of Professor Roentgen's discoveries in "X ray" photography. Professors Wright, of Yale, and Trowbridge, of Harvard, have already announced most satisfactory results of their efforts in this direction. Tesla states that Roentgen's discoveries are not exactly in line with work that he has been pursuing on similar principles and that therefore he does not wish to discuss the matter. Thomas A. Edison has also been experimenting with Roentgen's discovery, which he

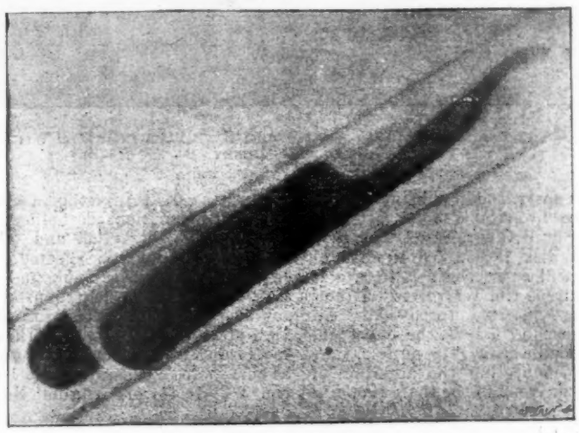


FIG. 1.—MR. A. A. C. SWINTON'S PHOTOGRAPH OF A HORN-HANDLED RAZOR IN ITS PASTEBOARD CASE. PHOTOGRAPHED BY LIGHT FROM A CROOKE'S TUBE.

terms rather a new development in the field of physics than an invention.

The New York daily papers, with characteristic enterprise, immediately secured news of these experiments as fast as they were made. Nearly all of the eminent scientists before mentioned agree that the greatest ultimate practical value of the discoveries will be in the field of surgery. It is expected that bullets imbedded in the flesh may be accurately located and that diseased portions of the various internal organs in the human body may be accurately determined. Outside of the domain of surgery, the field of application of "X ray" photography now appears to be almost limitless.

In a general and popular way the methods pursued by Professors Wright and Trowbridge are about as follows: The object to be photographed is laid upon a closed slide of an ordinary photographic plate-holder containing a highly sensitive dry plate. The light emitted from a Crooke's tube of suitable size is allowed to fall directly upon the object to be photographed without the intervention of a lens or any similar apparatus for focusing the rays. After a comparatively brief exposure, varying with the capacity of the Crooke's tube and the object to be photographed, the plate is developed as in ordinary photography with the exception that different chemical reagents are used.

Professor Wright has succeeded in photographing the lead in a lead pencil, the outer covering of wood appearing as a faint haze. He has also photographed through three thicknesses of leather the coins contained in a pocketbook, three metal balls through a pasteboard box, and coins through an inch of wood. Professor Trowbridge has made photographs of his own hand, in which the bones and their various processes show up very distinctly, while the flesh on the hand appears in a hazy outline.

The London *Electrical Review* for January 24, which reached New York on Monday of this week, speaks of Roentgen's work in part as follows:

Professor Roentgen, of Wurzburg University, has just made what promises to be an epoch-making scientific discovery. Professor Roentgen has discovered a new kind of light—or, at least, radiation—which penetrates wood and the flesh of men and animals without, however, penetrating bones and most metals. The professor has succeeded in photographing metal weights placed in a shut-up metal box without showing any more impression of the case than an ordinary photographic print shows of the glass of the negative from which it is taken. As far as we can learn from the imperfect accounts in the daily papers, Professor Roentgen's results were obtained by the light—or, at least, the radiation in some form—given out from a Crooke's vacuum tube when excited by an induction apparatus. These remarkable experiments of Professor Roentgen have already been successfully repeated by several physicists, and, notably, in this country, by Mr. A. A. C. Swinton.

The illustration on this page, Fig. 1, for which we are indebted to our London namesake, is reproduced from one of the photographs made by Mr. Swinton. It represents a horn-handled razor in its case of cloth-covered cardboard. The photograph was made through a piece of black vulcanized fiber .0212 of an inch thick. Mr. Swinton did not employ a lens of any kind and used "a vacuum bulb with two platinum-wire terminals penetrating through the glass, not at opposite points of the bulb, but at two points 90° apart. As, however, this bulb was not specially prepared for this experiment, there may, or may not, be any significance in these details. The bulb also contains phosphorescent material, but Mr. Swinton considers that that has no influence on the result. The terminals of the lamp are connected to Mr. Swinton's well known induction apparatus for producing rapid electric waves of high tension, such as have been produced by Tesla. Mr. Swinton has also tried a large induction coil to excite his lamp, but obtained no photographic effect with the same length of exposure, so there can be no doubt the rapidly alternating high-tension currents are better adapted for producing the Roentgen effect."

"The lamp is fixed on a convenient stand about a foot above the table, upon which a dark slide, containing an ordinary photographic plate, is laid. Before the sensitive plate is inserted into the dark slide in the dark room, a sheet of aluminium about $\frac{1}{100}$th of an inch thick is placed against the back of the shutter of the dark slide, so as to exclude the ordinary light when the shutter of the dark slide is drawn. The reason for this is that Mr. Swinton has discovered that the Roentgen rays penetrate thin aluminium better than the thin wood which forms the shutter. The arrangement, then, amounts to this, that the sensitive surface of the photographic plate is first covered with a thin sheet of aluminium to protect it from light, then upon this sheet of aluminium the object to be photographed is placed and exposed to the radiation from the lamp for about 20 minutes."

Recently Professor Roentgen read a paper on his new experiments before the Physico-Medical Society of Wurzburg. He insists on calling the rays which produced his photographs "X" rays, or "unknown" rays, as distinguished from cathode rays and the ultra-violet rays. According to the New York *Tribune* Roentgen gives his reasons for this, as follows:

In the passage through air, a smaller proportion of the X rays than of cathode rays are absorbed. Again, the direction of the latter can be changed by a magnet, while the course of the former can not. He believes, however, that the origin of the X rays is at that portion of the walls of the tube where the cathode rays produce the most brilliant phosphorescence. Now, with a magnet, one can turn the cathode rays so that they will impinge on a different spot, and the X rays will thus be generated in a new place. But wherever developed, the latter proceed thereafter in a straight line, unaffected by a magnet. The professor believes that it is unnecessary to have the walls of the vacuum tube entirely of glass. The impact of the cathode rays on an aluminium plate, or window, at the end of the tube, would be equally efficacious, in his opinion, in producing the newly found radiance.

Ultra-violet rays can (1) be turned from their course if passed from air into water of through carbon bisulphide, aluminium, rock salt and some other substances; (2) they can be reflected at the surface of the bodies named; (3) they are subject to the laws of "polarization," and (4) their absorption by bodies through which they pass depends on the density of the latter. Elaborate experiments by Roentgen himself show that the X rays behave in none of these ways. * * All these circumstances combine to suggest to Roentgen that the X rays are waves in the ether, moving, not to and fro across the line of progress, but longitudinally. But he frankly adds that "the hypothesis advanced still requires a more solid foundation."

THE ARNOLD ELECTRIC POWER STATION SYSTEM.

READ BEFORE THE NORTHWESTERN ELECTRICAL ASSOCIATION, MILWAUKEE, WIS., JANUARY 16, 1896, BY E. R. CUNNINGHAM.

(*Concluded from page 59.*)

Fig. 5 shows the plant as it would have been installed had it not been necessary to utilize the old machinery. Fig. 6 shows the method of connecting the generators to the engines by means of electric clutches. This method is to be used when it is necessary to start and stop either generator without stopping the other generator or the engine. Fig. 7 is the plan view of the Fort Dodge station, showing the method of increasing the plant (the dotted lines showing the machinery to be installed in the future), and also giving a sectional view of the mechanism. Referring now to the sectional view shown in Fig. 7, C *c* are hollow cast-iron quills or shafts mounted in bearings, P *p*, and carrying the armatures of generators Nos. 1 and 2, respectively. E is a steel shaft carried in bearings, D *d*, and extending each way from these bearings to the engine shafts, A *a*, and carrying upon its end disks, F *f*, securely keyed to the ends of the shaft. The quills, being carried in independent bearings, do not touch the shaft E, but clear the shaft one-half inch all around. On the ends of the engine shafts, securely keyed thereto, are disks, H *h*, corresponding with the ends of the quills C *c*, already described. These disks or couplings and the ends of the armature quills do not touch disks F *f*, but have a clearance of one-half inch in all directions, thus allowing shaft, E, with its disks, F *f*, to lie idle or passive in bearings, D *d*, while the quills revolve around it. When operating under normal conditions, engine No. 1 drives generator No. 1 directly coupled as follows: Three rectangular steel keys are inserted in slots U, spaced 120 degrees apart, and secured in place by suitable bolts, thus coupling disk H directly to quill C by means of these keys, but in no manner making connection with disk, F. The external view of this coupling, with its keys, is shown in Fig. 5. It will now be seen that the engine will operate generator No. 1 and not revolve shaft E. In a like manner engine No. 2 can be directly coupled to generators No. 2 and No. 3, so that there will be one small direct-coupled unit of one-third the capacity of the plant and one large direct-coupled unit of two-thirds the capacity of the plant always available without revolving any shafting or having any more wearing parts than in an ordinary direct-coupled plant. Now, suppose it is desired to couple generator No. 2 to engine No. 1, owing to generator No. 1 becoming disabled or for other reasons. To accomplish this it is only necessary to remove the three steel keys U and insert them in slots V, spaced 120 degrees apart, the keys being secured in place by suitable bolts. In this manner quill C is released from disk H and disk H coupled to disk F, which will cause shaft E to revolve when engine No. 1 revolves. If now there are inserted three additional steel keys in slots W, the effect will be to couple disk *f* to quill *c*, thus rigidly connecting the armature of generator No. 2 to the shaft of engine No. 1. Now remove keys from slots *u*. By starting up engine No. 1, generator No. 2 is driven directly coupled from it through the quill of generator No. 1, which is now standing still. In case it is desired to also drive generator No. 1 at the same time, it is done by inserting the keys in slots U, thus driving both generators from engine No. 1, and by similar connections with engine No. 2 any one or all of the generators can be driven from engine No. 2. Thus either one or all of the generators are available from the large engine unit and two of them available from the small engine unit, thus making it possible for a direct-coupled plant with but two engines and three generators to have the same flexibility as an ordinary direct-coupled plant with three engines and three generators, and at the same time saving the difference in cost between three small engines in one case and two engines—one large one and one small one—the combined power of which is equivalent to the three small ones, in the other case. By this method a saving in cost of foundations, cost of engines and cost of labor, fuel and oil to operate the plant is effected. If engine No. 1 were a compound engine, as would ordinarily be installed, and made sufficiently strong to allow high-pressure steam to be worked in the low-pressure cylinder, we would be able to drive generators No. 1 and No. 2 direct from engine No. 1 up to their full capacity, in case engine No. 2 should be disabled from any cause. The method described, of connecting the machines by means of mechanical clutches, is only applicable when sufficient time is allowed to permit stopping the machines for making the necessary connection, as in ordinary lighting plants, which operate about 12 hours a day. In case the engines and generators are operated continuously, an electro-magnetic clutch system has been designed, shown in Fig. 6, which permits coupling the generators and engines when running at full speed, and operates as follows:

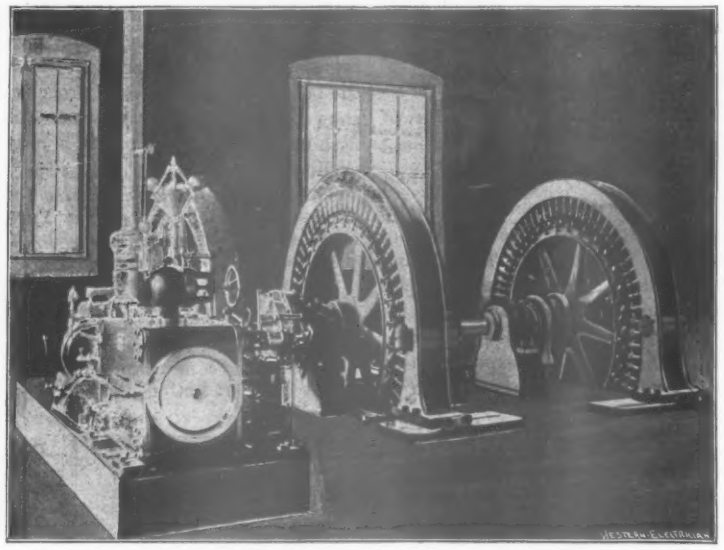


FIG. 5.—THE FORT DODGE PLANT AS IT WOULD HAVE BEEN INSTALLED WITHOUT USING OLD MACHINERY.

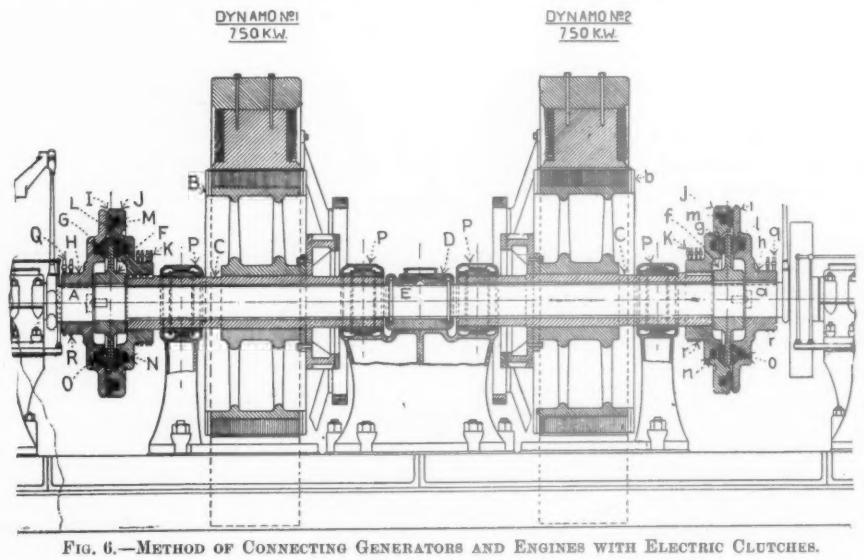


FIG. 6.—METHOD OF CONNECTING GENERATORS AND ENGINES WITH ELECTRIC CLUTCHES.

Referring to Fig. 6, shaft E carries on its ends disks F *f*, similar to the one hereinbefore described. These disks carry wrought-iron rings or armatures L *l*, G *g*, which are secured to the disks by round gudgeons or studs. The circular rings are held against the disks by coil springs surrounding these gudgeons, so that when the rings are not attracted by the passage of current through the coils, hereinafter described, they remain compressed against disks F *f* and do not touch disks H *j*, *h j*. Disks H *h*, which are secured to the engine shafts, carry also circular wrought-iron disks I *i*, which are attracted by coils M *m* when necessary. Coils M *m*, O *o*, N *n* are copper wire wound in recesses and suitably arranged by means of brushes K *k* and Q *q*, whereby current can be passed through them so as to attract the circular rings or armatures mentioned when necessary for coupling up.

By means of the magnetic clutch, formed by passing current through coil M, thereby attracting disk I, which positively connects disk H to disk J, dynamo No. 1 is driven from engine No. 1 without revolving shaft E, and in like manner engine No. 2 can be made to drive dynamo No. 2.

In case dynamo No. 1 becomes disabled and it becomes desirable to couple dynamo No. 2 to engine No. 1 and shut down dynamo No. 1, current is passed through coil O, which attracts armature G, thus coupling engine shaft A to shaft E through disk F. Current is now passed through the field and armature of dynamo No. 2 in such a manner as to make an electric motor of it, and when it reaches the same speed as engine No. 1, shown by a suitable indicator, current is passed through coil *n*, thus attracting circular armature *g* and coupling disk *f* to disk *j*, or securely connecting shaft E to the armature of generator No. 2. Now, generator No. 2 is being driven directly from engine No. 1, and the current is now cut off from coil M, thus disconnecting the armature of dynamo No. 1, allowing it to come to rest. In a similar manner dynamo No. 1 can be coupled to engine No. 2, or either generator or both generators can be coupled to either engine, thus making an absolutely flexible direct-coupled plant, and by using compound engines so designed that steam can be worked in the low-pressure cylinders, both generators can be driven to their maximum capacity from either engine and allow one engine to stand still for repairs.

Another important feature of the system is the fact that any standard make of dynamos and engines can be utilized, thus necessitating no radical departure from the present lines of manufacture. For this reason many of the present plants can be rebuilt to conform to this system, utilizing a large part of their old equipment. Thus, at Fort Dodge, we had two high-speed engines and four Thomson-Houston arc light machines. The engines were not very efficient, being of the common slide-valve type. They would not bring much on the market and we did not wish to throw them away, so we installed an auxiliary shaft, ordinarily driven from the sheave shown in Figs. 1 and 2. At either end of this auxiliary shaft we installed one of these old high-speed engines, to be used only in case of emergency. Upon this auxiliary shaft are placed friction clutch pulleys, which are belted to the old Thomson-Houston arc machines. It will thus be seen that power from any one or all of the

four engines is available for any one or all of the seven machines which we have thus far installed. This makes the question of a break-down practically impossible.

This system is subject to various applications, Fig. 8 representing its adaptation to an electric lighting plant operating alternating and arc lights. It will be noticed that this plant has four alternating generators and four arc light generators, all running at the same speed. Each armature is carried on a quill in independent bearings of its own, and arranged to be connected to the shaft by means of magnetic or positive jaw clutches, as desired. The shaft is separated in the middle, so that either portion can be shut down while the other is in operation, and on each end is placed a steam engine of some improved form. With such an arrangement it is possible to start and stop any generator in the plant without stopping either engine. The dynamos being brought up to speed as motors, the clutches which connect them to the driving shaft are then thrown in, and by means of suitable switches the machines are converted into generators, and then can be cut in on the line for active service. The system comprises numerous electrical devices for controlling the speed of these machines and otherwise making the plant easy to handle.

Fig. 9 shows the design used for isolated plants in office buildings and apartment houses. In this case one of the engines can be a steam engine, which can be used for operating the lights of the building through the Winter months, the exhaust steam being used for heating the building, while in the Summer months the lights are driven from a gas engine located on the other end of the shaft, and the steam plant allowed to stand idle. The result is a great reduction in the cost of labor during the Summer months, and at the same time it is possible to have practically a duplicate plant with but a single investment, as either generator can be operated from either engine.

The Fort Dodge plant started July 1, 1895, very successfully, and has been in operation ever since, without any expense for repairs, so far as it relates to this system. The bearings all being arranged so that a box can be removed and a new one substituted within a very short time, and there being but three sizes of bearings, by carrying one extra piece for each bearing we are insured against shut-downs, caused by the bearings. The consumers, being assured of constant, uninterrupted service, have been willing to pay a first-class price to have their buildings properly wired. They have also been willing to pay for the very best material and to have the work done according to insurance rules and the best modern practice. As an illustration of how carefully this has been done, every drop cord has been soldered and taped in every socket and rosette. The value of this can not be overestimated, the result being that a short circuit is a thing unknown, and the company is not obliged to go to the expense of keeping a trouble man and the consumer is never out of light.

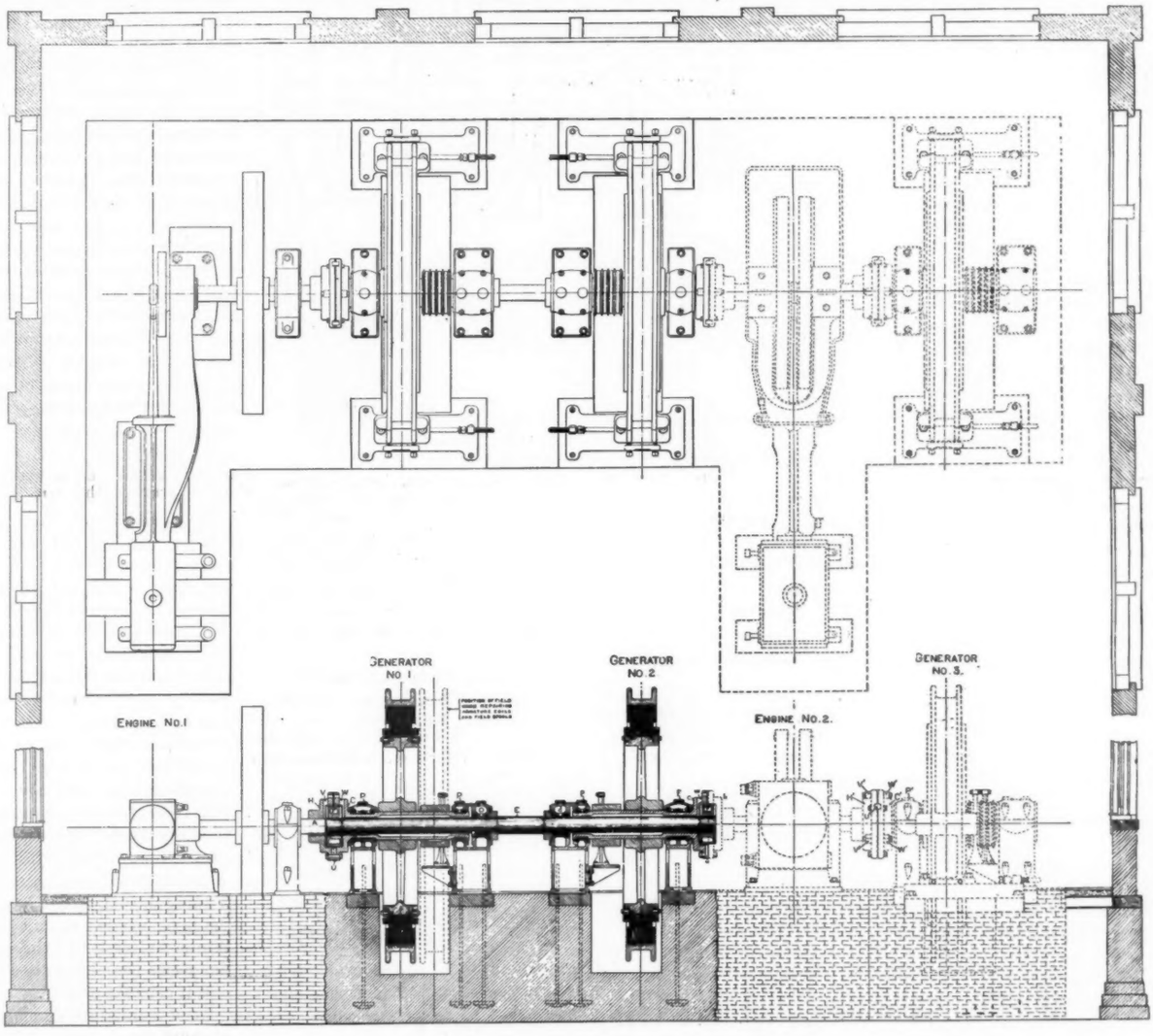


FIG. 7.—PLAN VIEW OF THE FORT DODGE STATION.

PERTINENT OBSERVATIONS—IV.

A recent reference in these columns to a case where quite a considerable current was carried some 100 feet or more on a 50-volt circuit at a very low loss, might naturally suggest the inquiry, Why not use 100 volts? At the present day there is really, it would seem, no reason. The way in which 50 volts came to be adopted as the standard voltage for the secondary circuit of transformers was this: For one thing, the advocates of high-tension distribution wished to claim that their secondary circuits were even safer than the 100-volt direct circuits, as their pressure was less. Another cause was that in some quarters at one time there was a notion that possibly a 50-volt lamp might escape the Edison lamp patent on the ground of not possessing the qualities of resilience and *high* resistance to a sufficient degree, but the controlling fact was the inefficiency (at the time of the introduction of the alternating system) of the 100 or 110-volt lamp, which at that date usually required from three-fourths to eight-tenths of an ampere. Thus, with a ratio of transformation of 20 to 1, one ampere in the 1,000-volt primary would give 20 lamps in the secondary, as it was practicable to obtain one-ampere 50-volt lamps of fair life, while with a ratio of 10 to 1 only about 12 to 15 lamps were obtainable. Again, the rule in the early days was to have small converters and short secondary circuits.

Now that the poor economy of a large number of small transformers is recognized, and a one-half-ampere 100-volt lamp having a fair life is obtainable, there seems no especial reason for retaining the 50-volt circuit. Particularly in large secondary installations and with a considerable distance to run should 100-volt distribution be employed, and in many cases the three-wire arrangement of two converters in series with an intermediate neutral may be used with advantage.

Every now and then we see the question of the municipal ownership of electric lighting plants revived in a spasmodic manner. It seems strange that people will insist on discussing this matter in the almost total absence of reliable figures. In many cases the data furnished by the advocates of municipal control have been clearly shown to be erroneous, and in none are the figures relied on as trustworthy. A private corporation, for its own protection, keeps proper and accurate books of account, but as for municipal corporations, except possibly in Massachusetts—where there has been some legislation on the subject—it is notorious that only a very small proportion have any idea where "they are at" on this question.

J. E. T.

OUR BOSTON LETTER.

The Buckeye Electric Company, of Cleveland, Ohio, is now represented in this city by Mr. Edward L. Nash, who has been appointed general New England agent for the company, and he will push the sales of Buckeye incandescent and Manhattan arc lamps actively in this territory. Mr. Nash has been connected for the past two years with the Brush company, and, in handling their apparatus, has become well acquainted with the eastern trade. He has opened an office at 620 Atlantic avenue, and is getting around among his old friends and making new friends as fast as possible.

The Dynamo Electric Maintenance Company have removed their offices in this city from 195 Milk street to 180 Summer, where they can obtain more space and facilities for light repairing which their growing business requires. Manager Eneas states that the company are doing a very satisfactory amount of work, and that the New York and Philadelphia branches are rapidly getting on a paying basis.

The New England Electric Supply Company is the latest addition to the trade in this section, and the company are now busily engaged in fitting up their quarters at 49 Federal street, and getting together an extensive line of supplies. They are centrally located and have unusual facilities for handling business. The salesroom is large, bright and airy, containing 4,200 square feet of floor space, with ample storage room, and every convenience for packing and shipping. The members of the concern are, Henry Cole, president; Bracey Curtis, secretary and treasurer; John S. Keenan, manager, and Harry N. West. Most of these gentlemen are already well known to the trade, Messrs. Cole and Keenan from their connection with the Holtzer-Cabot company, and Mr. Curtis as New England manager of the Warren Electric Specialty Company. They start in admirably equipped in every way, and confidently expect to handle a large share of the supply trade of New England.

Interesting experiments in the photography of opaque bodies by "X" rays generated by electricity, on the lines of discovery by Prof. Roentgen, have recently been carried on at both Yale and Harvard universities, and, it is claimed, with a large measure of success. Prof. Trowbridge, of the Jefferson physical laboratory at Harvard, and Prof. A. W. Wright, in charge of the Sloane physical laboratory at Yale, have conducted a series of almost similar experiments, using a Crooke's tube, and both have succeeded in obtaining a number of fine plates. Prof. Wright states that there seems to be no limit to the possibilities of photography through opaque bodies, of which the human body offers the best possible subject. The field here opened to diagnosis without the aid of the surgeon's knife can be readily imagined. H. G. T.

Boston, February 1.

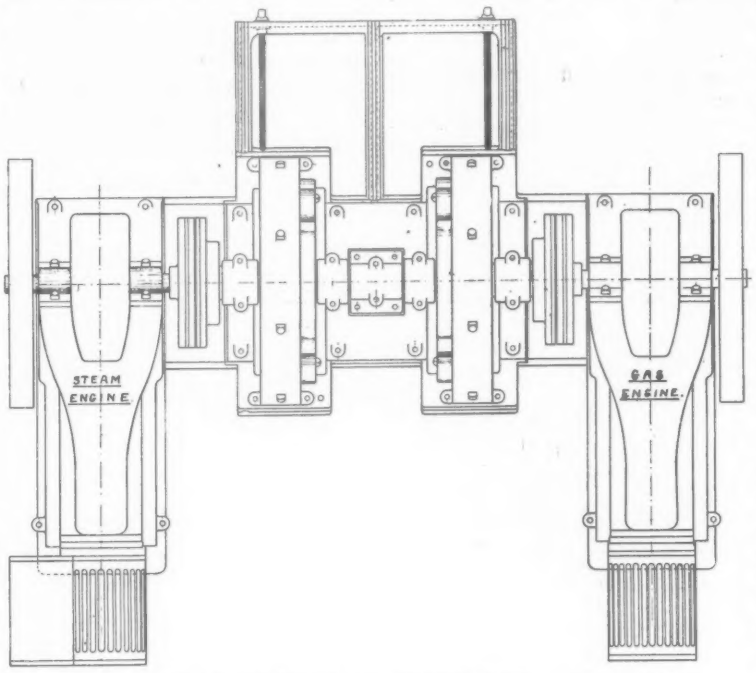


FIG. 9.—THE ARNOLD SYSTEM FOR ISOLATED PLANTS. (See page 77.)

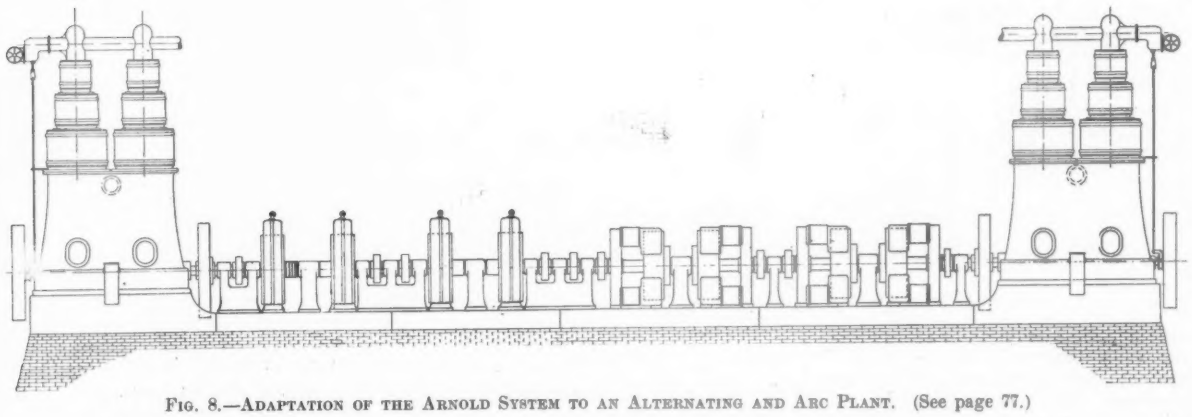


FIG. 8.—ADAPTATION OF THE ARNOLD SYSTEM TO AN ALTERNATING AND ARC PLANT. (See page 77.)

Bell Telephone Output.

The output of the American Bell Telephone Company for the month ended January 20, 1896, shows as follows: Gross output, 17,620, increase, 9,989; total outstanding, 686,588 against 584,192 in 1894, an increase of 102,396.

Mr. E. W. Little, for several years vice-president and general manager of the Interior Conduit and Insulation Company, of New York, resigned his official position last week, but remains as a stockholder. Mr. Little, after a short respite, will again enter the electrical field.

Trolley Work on Long Island.

The Patchogue & Port Jefferson, L. I., Traction Company has been incorporated with a capital stock of $400,000; $100 shares. The officers are Edwin Bailey, president, Patchogue, L. I.; O. T. Fanning, vice-president, Riverhead, L. I.; Frank Miller, treasurer, Bridgeport, Ct.; John Roe Smith, assistant treasurer, Patchogue, L. I.; J. B. Swezey, secretary, Patchogue, L.I. Several prominent men are connected with this enterprise, among them being Fred C. Cocheu, secretary of the Nassau road, of which P. H. Flynn is president, who is one of the directors of the Patchogue & Port Jefferson company. Work will be commenced as soon as the right of way can be secured.

A Comprehensive Calendar.

The Electric Appliance Company, of Chicago, have issued and distributed a very attractive calendar for 1896. They have combined with the calendar a carefully prepared moonlight schedule for the entire year of 1896, making the calendar doubly useful as well as ornamental.

The Edison Electric Illuminating Company of New York makes the following statement of earnings, including the Harlem and Manhattan companies, for December and the 12 months of 1895:

December.	1895.	1894.	Increase.
Gross.....	$200,745.56	$196,089.83	$4,655.73
Net.....	107,235.35	95,598.60	11,636.75
Gross, 12 mos.	1,859,721.91	1,689,374. 25	170,347.66
Net, 12 mos.	915,758.74	789,466.58	126,292.16

ELECTRIC RAILWAY PROGRESS IN NORTHERN OHIO.

SUCCESS OF EXISTING ROADS—EXTENSIONS CONTEMPLATED.

The effect of electric suburban railroad transportation has already been keenly felt by one of the steam railroads running out of Cleveland, Ohio. Since the Akron, Bedford & Cleveland Electric Railroad line has been completed and been placed in running order it is estimated that three-fifths of the traffic between Cleveland and Akron have passed over this road, to the exclusion of the steam railroads. The Cleveland, Akron & Columbus Railroad (steam), a line of the Brice system in Ohio, has withdrawn four of its passenger trains because of this active competition. Two of these trains ran between Cleveland and Orrville and two between Hudson and Millersburg. The traffic between Cleveland and Akron and between Akron and points south of that flourishing city had kept these trains busily employed for a number of years. In fact, it was to obtain that traffic that they were maintained. They could not stand electric railroad competition. The matter of reducing the fare to that charged by the electric railroad was considered, but the passenger agent of the steam railroad did not believe it would pay. To his mind it would be better to take the trains off the line entirely and let the electric railroad have undisputed sway until people were convinced that electric railroad transportation was a failure or was such a success that they would not patronize the steam railroads in any event.

This was a most fortunate beginning for this important suburban company, and it was estimated that the road would speedily begin paying expenses and making something for its projectors. Unfortunately the collapse of a bridge on the line over a high ravine near Cleveland has seriously interfered with traffic for some weeks as well as entailing much extra expense to the electric line. Even with that piece of misfortune the steam railroads, running in competition, have given up the fight against electricity, for the Winter at least, and the new Akron line seems bound to have all the business it can take care of.

Good results are announced at the offices of the Cleveland & Elyria Electric Railroad Company. The line is about the same length as that from Cleveland to Akron, and it has been extremely well patronized. The cars run a trifle slower, and the fact that the speed has not been up to the standard of the steam lines operating to Elyria doubtless has hurt traffic a little. In the face of that fact, however, over 2,500 people traveled on the road in the first five days after it was placed in running order. No question seems to exist as to its complete success, and it is probable the projectors wish that it might have been double-tracked.

J. B. F.

Cleveland, January 25, 1896.

ADVANCE INFORMATION

Valuable News and Tips for Manufacturers and Dealers.

We publish below information relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW.

Electric Light and Power.

NEW ORLEANS, LA.—J. F. Cohn and M. Ber have obtained the electric light franchise for which they recently applied, and will organize a company with a capital stock of $300,000 to build an electric light plant.

WASHINGTON, D. C. — National Gas Light, Heat and Power Company has been incorporated by Chas. D. Hauk, F. P. B. Sands, Park Agnew and Anthony Pollock. Capital stock, $2,000,000.

QUINCY, FLA.—The Quincy Electric Light, Heat and Power Company will erect an electric light plant.

FRESNO, CAL.—Kings River Electric Power Company has been incorporated by S. F. Earl, J. S. Jones, James Sibley, Charles D. Wilcox and W. H. Hammond. Capital stock, $360,000.

BALTIMORE, MD. — The Edison Electric Illuminating Company, Alfred A. Galsier, of Boston, president, has made two propositions to Mayor Hooper. One of these contemplates constructing conduits for its own lines, or it will build a general subway system. It is stated that the city has ample authority to act.

SALISBURY, N. C.—The Kestler Manufacturing Company will install a 250-light electric plant in its mill.

HARRISON, N. J.—The Newark People's Light and Power Company has been awarded the contract for erecting the new electric light plant.

FORT VALLEY, GA.—The Fort Valley Electric Light Company has been organized, with W. H. Harris, president; Geo. H. Happey, secretary, and S. T. Neil, manager. They will erect an electric light plant and put it in operation in 60 days.

ORANGE, N. J.—The People's Electric Company, Philip Nye Jackson, manager, will construct an electric lighting station immediately. It will be equipped with the most modern machinery.

MILBURN, N. J.—Carrol P. Bassett, who represents the Summit Electric Light Company, has made a proposition to the township committee to light the township by electricity. The proposition was favorably considered and Mr. Bassett was requested to make it in writing, when action would be taken on it.

BROOKVILLE, OHIO.—The electric light question is being agitated here.

GEORGETOWN, D. C.—The new plant of the Potomac Light and Power Company will be in operation by April 1.

DAVENPORT, ILL.—The contract for lighting this city has been awarded to Walsh Brothers, of Clinton.

ST. PAUL, MINN.—The Acme Street Lighting Company has been incorporated. The capital stock of the concern is placed at $10,000. The incorporators are Jacob Heilbron, August Krebs and Charles E. Pettingill, of St. Paul.

DETROIT, MICH.—The Park Board has asked the Public Lighting Commission to furnish electric lighting on Belle Isle, west of Vista avenue, and on the boulevard and small parks. It was also asked that the wires be placed underground.

TRENTON, N. J.—Citizens' Electric Light Company has been incorporated by P. J. Berry, Edward A. Fisher, George Hildebrecht and John M. Burgner. Capital stock, $100,000.

SYRACUSE, N. Y.—The Electric Light and Power Company will extend its plant.

JERSEY CITY, N. J.—The Crossley & L'Hommedieu Heating Company has been incorporated by John K. l'Hommedieu, Seward Baker and Charles Crossley to erect and supply all kinds of electric heating and lighting apparatus, etc. Capital stock, $50,000.

WEST DAVENPORT, ILL.—The West Davenport Improvement Company has been incorporated by E. S. Carl, George P. Baker, Louis A. Ochs and P. A. Murphy to buy, sell, construct and deal in railways, waterworks, electric light and power plants, etc. Capital stock, $500,000.

BANGOR, ME.—Morse & Company will light their immense plant on Valley avenue by an independent electric system. The new plant will run 300 or more lights.

ST. CLOUD, MINN.—The St. Cloud Water, Light and Power Company, temporary receiver appointed by Judge Searle. Assets, $447,000; liabilities, $25,000.

BRIDGETON, N. J.—The Crystal Ice and Cold Storage Company has been incorporated by C. Frank Cox, B. F. Bradford, H. D. Powell, John Ogden and others to sell and manufacture light, heat and power, etc. Capital stock, $50,000.

PORT JEFFERSON, N. Y.—The Port Jefferson Electric Light Company has been organized by W. T. Wheeler, E. M. Davis, J. V. N. Bergen, C. P. Randall, C. Fred Purick, Carl Schetter and H. M. Randall. The directors organized by electing J. V. M. Bergen, president; C. P. Randall, vice-president; W. T. Wheeler, secretary and treasurer. The company will begin operations immediately. Capital stock, $7,500.

NORFOLK, NEB.—The Norfolk Electric Light and Power Company has leased its plant to H. H. Patterson for a period of five years, beginning February 1.

New Electric Railways.

TEMPLETON, MASS.—The Templeton Street Railway Company has been incorporated by Isaac Baum, S. F. Greenwood, John F. Chamberlin and C. E. Ingalls. Capital stock, $50,000.

MANSFIELD, OHIO.—The Mansfield, Savannah & Wellington Electric Railroad Company has been incorporated by Thomas Y. McCray, Nelson Ozier, B. F. Platt and Thos. B. Martin. Capital stock, $100,000.

SAN FRANCISCO, CAL.—It is understood that the Market Street Railway Company will, during the coming year, not only change their two steam lines to the ocean into electric, but will also build an electric line the full length of Point Lobos avenue.

POTTER PLACE, N. H.—There is a fair prospect that this place and New London hill will soon be connected by an electric road.

PITTSBURGH, PA.—It is again reported that the Second Avenue Traction Company will shortly acquire the plant of the Duquesne Traction Company.

ALBANY, N. Y.—The New York & Staten Island Traction Company has been incorporated. Capital, $2,500,000. Directors: C. L. Horton, A. D. Chandler, D. H. Shea, F. P. Lowery and W. R. Morrison, of New York.

TARRYTOWN, N. Y.—Tarrytown Electric Railway Company has been incorporated by Robt. E. Hopkins, Geo. B. Newton, John C. Barron and Robert Sewell, of Tarrytown; John D. Archibald, Wm. N. Crane, Jos. Eastman, Louis Stone and Wm. Rockefeller, of New York; to build a street surface electric road four miles long, from Tarrytown to Elmwood, Westchester County. Capital stock, $50,000.

BALTIMORE, MD.—The Columbia & Maryland Electric Road, section between Baltimore and Ellicott City, is expected to be completed by June 1; also the section between Washington and Lorely.

HAGERSTOWN, MD. — W. F. M. McCartey is endeavoring to obtain a franchise to build an electric line.

New Manufacturing Companies.

ROANOKE, VA.—Virginia Electrical Engineering Company has been incorporated, with Chas. Adamson, president; W. H. Triol, vice-president; G. C. Callahan, secretary. Capital stock, $10,000.

NEW YORK, N. Y.—United States Nickel Manufacturing Company has been incorporated to make anodes, do electro-plating and make castings. Capital, $2,000. Directors, Henry Lanisberg, William A. Carman and Jacob H. Belvin, of New York city.

CLEVELAND, OHIO.—Forest City Electric Company has been incorporated by Wm. B. Cleveland, Robt. N. Lowe, Frank H. Neff, Wm. H. Wherry and W. G. Cleveland. Capital stock, $25,000.

BROOKLYN, N. Y.—The John Landon Company has been incorporated to manufacture street car fenders and other mechanical implements. Capital, $50,000. Directors, John Landon, William H. Harvey, Thos. J. Kenna, Samuel S. Whitehouse, Chas. E. Arbruster, John J. Coleman and George H. Isham; all of Brooklyn.

PHILADELPHIA, PA.—The Electric Carriage and Wagon Company has been incorporated by Victor H. Conkle, Maurice Barnett, Ralph Gibson and others. Capital stock, $10,000.

Business Troubles.

BRIGANTINE, N. J.—Joseph Thomson has been appointed receiver of the Brigantine Transit Company, owning the electric road at this place.

CHATTANOOGA, TENN.—The Chattanooga & North Side Street Railroad Company has been placed in the hands of a receiver.

New Telephone and Telegraph Companies.

CLARKSVILLE, N. Y.—Clarksville Telephone Company has been incorporated to run a line from Albany to this place. Capital, $2,000.

Increase of Capital Stock.

CHESTER, PA.—The stockholders of the Chester Electric Light Company voted to increase the bonded indebtedness of the company from $35,000 to $100,000.

Destroyed by Fire.

ST. LOUIS, MO.—Aloe & Company, electrical instruments, etc., 415 Broadway, destroyed by fire, at a loss of $25,000.

The New Haven Car Registers Triumphant at Atlanta.

The New Haven Car Register Company, of New Haven, Ct., manufacturers of the famous "New Haven" fare registers, have been awarded the highest medal and diploma given on fare registers at the recent Cotton States and International Exposition, at Atlanta, where they made a very fine exhibit of their full line of single, double and triple registers.

This company also received the highest award at the Columbian Exposition and have been very successful in anticipating the requirements, in their line, of modern street railways. Their registers have been adopted by many of the leading roads of the country and attract attention at once by their very rich and elegant appearance, and win friends everywhere by their completeness and durability. The double and triple registers are rapidly becoming very popular for the registration of different classes of fares, or fares and transfers.

The managers of street railways are rapidly coming to realize the necessity of registering transfers separately from the cash fares, and the double registers made by this company accomplish this in the most complete manner.

The ELECTRICAL REVIEW is pleased to congratulate this company on their enterprise and the success they have achieved, which is thoroughly deserved.

LITERARY.

The Lehigh University, South Bethlehem, Pa., has issued a very interesting pamphlet, giving details of its course in mechanical engineering. The university also presents a good course in electrical engineering.

The February number of *The Forum* (which, by the way, closes the first decade of *The Forum's* existence) is, in many respects, a notable number. The Venezuela crisis naturally forms the leading feature of the number, being thoroughly discussed from different points of view by three distinguished writers.

Dixie, our southern contemporary, sent out a neat souvenir during the recent convention of the National Association of Manufacturers, at Chicago. It consisted of a cotton boll attached to a folder giving pictures and facts relating to the cotton industry. The cotton crop of the United States last year was 9,900,000 bales.

The society magazine, *Form*, published by Dempsey & Carroll, New York, has been greatly improved under its new editorial management and is now one of the most interesting ladies' magazines published. It is filled with current matters of interest to ladies of fashion and is well illustrated with half-tone portraits of prominent society leaders.

The International Correspondence Schools, Scranton, Pa., have begun the publication of a new paper entitled *Home Study*, an elementary monthly journal for students of the industrial sciences and readers of the technical press, who need a better knowledge of arithmetic, geometry, trigonometry and the principles of physics and drawings to enable them to derive the best results from their reading.

Scribner's Magazine for February might be called a midwinter outdoor number, as it contains an unusual number of articles of life and adventure in the open air. First among these is the leading article of the number on the Colorado Health Plateau, by Louis Morris Iddings, which is a delightful social study by a man who has traveled in many regions of the world and who knows the region around Colorado Springs thoroughly, having spent a number of Winters there.

A delightful literary treat is the February number of *Current Literature*. It opens with timely editorials on Turkey, the Blue Beard of the Orient, and Is Patriotism a Lost Art? and Journalism and Laundries. Among the specially notable articles in a number that does not contain one dull line are: An excellent account of "The Monroe Doctrine;" a page sketch of the new Poet Laureate, and a stirring dramatic scene, "Dollie Goes to the Sun," from Annie E. Holdsworth's novel, "The Years that the Locusts Have Eaten."

In *McClure's Magazine* for February, Mr. Harry Perry Robinson, editor of *The Railway Age*, describes, section by section, bringing in all the dramatic incidents, the recent speed-run from Chicago to Buffalo—the fastest railroad run ever made in all the world. Mr. Robinson was one of the official time-keepers, and, being an experienced writer on railroad topics, tells the story as no one else possibly could. The paper is illustrated with pictures of the locomotives that drew the train, portraits of the engineers who operated them, and snap-shots taken from the train when it was making 80 miles an hour.

We have received from Charles D. Walcott, director of the United States Geological Survey, Part III of the "Sixteenth Annual Report of the United States Geological Survey." The volume treats of the metallic products of the United States, and, together with Part IV of the same report (which has not been received from the public printer), will form the direct continuation of the series of reports issued by this bureau under the title of "Mineral Resources of the United States," from 1882 to 1893. The cost of printing and binding is no longer charged for this book, and by making prompt application to a senator or representative the volume may be obtained, as the congressional distribution of the book will soon ensue.

OUR CANADIAN LETTER.

PORT ARTHUR, ONT.—The by-law to provide $15,000 for electric light has been defeated.

BROCKVILLE, ONT.—The proposed electric railway, to be built by the Electric Street Railway Company, will be commenced before October.

QUEBEC, QUE.—Mr. Beemer, the promoter of the electric railway scheme, is said to have made arrangements for the immediate construction of the road.

HAMILTON, ONT.—A company is being formed to open a Summer resort at Chedike Park and to build a double-track road. The capital stock will be $310,000.

TORONTO, ONT.—The Toronto Electric Light Company have invited tenders for pile driving and the necessary excavating for the foundation of their new power house.

HULL, QUE.—T. Viau, of the Hull Electric Company, which proposes to construct an electric railway between Hull and Aylmer, writes that he has a first-class water power, and is forming a joint stock company to build the line, which will be seven miles in length. In the electric lighting, 3,000 incandescent lights and 100 arc lamps will be used. Probable cost of the work, $65,000. J. A. C.

Montreal, January 30.

KIND WORDS.

"THE BEST IN AMERICA."

TO THE EDITOR OF ELECTRICAL REVIEW:

I shall be very much pleased to receive the ELECTRICAL REVIEW. It is the best electrical paper in America. R. K. DUNCAN.

January 27, 1896.

WANTED.

Position by a young man now employed as chief station man at a splendid electric light and water plant. Have been with present company four years. Thoroughly experienced with various systems of electric lighting from the coal pile up. All-round practical man capable to install machinery. References A1.

"Engineer,"
Care of ELECTRICAL REVIEW,
13 Park Row, N. Y.

WANTED.

A first-class, intelligent electrical superintendent capable of making plans, securing contracts, and superintending the general electrical construction work of the construction department of an electrical supply house. Must be capable, active, and able to figure carefully and correctly. Eventually might become interested in one of the largest and most successful electrical supply houses in the West.

Address "Interior Conduit,"
Care of ELECTRICAL REVIEW,
New York City.

WE DESIRE TO CORRESPOND with parties who manufacture or handle BICYCLE SPECIALTIES, especially in the electrical line. Address

PACIFIC ELECTRIC COMPANY,
108 Tenth Street,
Tacoma, Wash.

WANTED.

Position as electrical engineer, superintendent or manager with an electric street railway company. Several years' experience, and references from former road, from which I resigned for a year's practice in Europe. Street railway preferred, but could manage large electric lighting plant.

Address "S. B.",
Care of ELECTRICAL REVIEW,
13 Park Row, N. Y.

PROPOSALS FOR LIGHTING THE CITY OF KEOKUK, IOWA, WITH ELECTRICITY.

Sealed bids will be received by Sumner T. Bisbee, Clerk of Council of the city of Keokuk, Iowa, until 12 o'clock noon of Friday, February 21, 1896, for lighting the city of Keokuk with 140, more or less, arc lights, in accordance with specifications now on file with, and copies of which can be had of, Sumner T. Bisbee, Clerk of Council of Keokuk.

Said contract to be for the term of five years from and after May 3, 1896.

Said bids to be opened and acted upon at a special meeting of the Council to be held Friday, February 21, 1896, at 7.30 P. M.

The Council reserves the right to reject any or all bids.

SUMNER T. BISBEE,
Clerk of Council,
January 25, 1896. Keokuk, Iowa.

McINTIRE'S
PATENT CONNECTORS AND TERMINALS
FOR ALL ELECTRICAL PURPOSES.
THE C. McINTIRE CO.,
12-14 Franklin St., Newark, N. J.

FUSE WIRE OR LINKS.
CORRECT CARRYING CAPACITY.
ABSOLUTE UNIFORMITY.

The INDEPENDENT ELECTRIC CO.
39th St. and Stewart Ave., Chicago.

WANTED
Second-hand Dynamo
to run 400 Incandescent Lights. Reply to
A. CAMERON,
Care of F. C. Austin Mfg. Co.,
CHICAGO, ILL.

"A B C OF ELECTRICITY,"
By MEADOWCROFT.
FOR BEGINNERS
Price, 50 Cents.
ENDORSED BY THOS. A EDISON.
PUBLISHED BY
Electrical Review,
13 Park Row, New York.

SIGN LAMPS.
An Economical, Practical and Sightly Novelty in Electric-Lighted Signs.
SURE TO ATTRACT ATTENTION.
For full information and prices, address
DICKINSON ELECTRIC SUPPLY CO., 150 Nassau Street, New York.

A good telephone cord is one of the things always in demand. The "Duro", made by C. H. McEvoy, of Lowell, Mass., is claimed to effectually fill the bill, and it will be cordially greeted by telephone and switchboard manufacturers and users everywhere.

The Joseph Dixon Crucible Company, of Jersey City, N. J., sends us each month a favor that exactly "fills the bill." It is a blotter and calendar for the month combined in one piece, and an artistic design always adorns the calendar. It is a looked-for and welcome reminder.

A Lamp Valentine.—The manufacturers recently received from one of their customers an interesting souvenir in the shape of an old, burned-out Packard lamp, together with a valentine card, on which was written: "This lamp has been in constant use for two years and three months." Accompanying the valentine was the following letter:

GENTLEMEN: I herewith send you a valentine souvenir which would be a curiosity if placed in your new catalogue. Trusting you may appreciate this little memento and keep it for future reference, we are, Very respectfully yours,
THE CINCINNATI GAS LIGHT AND COKE CO.,
Electrical Department,
C. F. Vesser, V.-P. & G. M.

The Electric Appliance Company has had the souvenir on exhibition at 242 Madison street, Chicago, where it has attracted considerable attention. A lamp which has burned over 19,000 hours is certainly entitled to more than ordinary respect. The Electric Appliance Company, by the way, is now enjoying the biggest trade in its history.

Russian Thistles for Fuel.

News comes from Chamberlain, S. D., that a roller mill at Castalia is using two tons of Russian thistles or "tumble weed" per day for fuel. The mill company pays $1.50 a ton for all the thistles the farmers bring in. When dry the thistles burn like pine cones, and, although they burn rapidly, the heat they give off is intense. It is possible that the Russian thistle may find a use as fuel in plants for the generation of electric current.

The Columbia Incandescent Lamp Company.

The above company, since its increase of facilities, has found that the addition was made none too soon. New customers and large orders are the result of the day in the mail of this wide-awake and ably managed St. Louis lamp company.

New York Electrical Society.

The 171st meeting of this society was held at Columbia College, Madison avenue and Forty-ninth street, last Wednesday evening at eight o'clock.

Mr. Herbert Lloyd lectured on "Recent Improvements in America and Europe in the Storage of Electricity."

Mr. Lloyd, who is connected with the active management of storage-battery interests in this country, has just returned from a trip to Europe, undertaken for the purpose of investigating all the recent work in progress there involving the utilization of stored electricity. Mr. Lloyd had a large amount of interesting and valuable information to communicate, entirely new, to the American electrical public, and threw considerable light on the relative conditions of storage-battery development, technical and industrial, in this country and on the other side of the water.

A Taylor Battery Found.

TO THE EDITOR OF ELECTRICAL REVIEW:

I noticed in the last issue of your valuable journal, January 22, an inquiry in regard to a Taylor battery signed C. M. E., of Everett, Pa. You may inform the gentleman, if you will kindly, that I have one that is new and never been used which I will dispose of for a very reasonable price.

Yours truly,
CHAS. E. HERRIMAN.
Girard, Kas., January 27, 1896.

The Edison Illuminating Company, of St. Louis, Mo., which is successor to the Municipal Electric Lighting and Power Company of that city, does a very large lighting business and is constantly adding to its territory. It is ably managed by the following gentlemen: S. M. Dodd, president and general manager; S. B. Pike, secretary and assistant general manager; Jno. G. Kelly, treasurer, and H. A. Wagner, superintendent.

ELECTRIC CONDENSERS.
WM. MARSHALL,
Manufacturer.
STANDARDS A SPECIALTY.
709 LEXINGTON AVENUE, NEW YORK.

ROYCE & MAREAN,
DEALERS IN
Electrical Supplies,
WASHINGTON, D. C.

AMMETERS and Voltmeters for Alternating and Direct Current Circuits in Laboratory and Station.
WHITNEY ELECTRICAL INSTRUMENT CO.,
PENACOOK, N. H., U. S. A.

INDIA MICA
SOLID, SHEET, UNCUT.
CUT AND STAMPED.
Send for Samples and Quotations
A. O. Schoonmaker,
Importer.
156 WILLIAM STREET, NEW YORK.

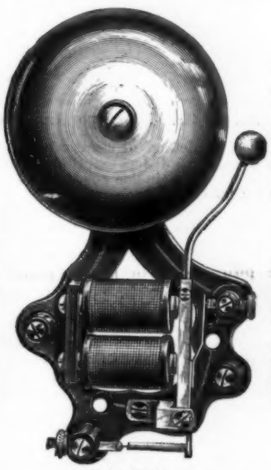
ESTABLISHED 1867
PARTRICK & CARTER CO.
ELECTRICAL SUPPLIES
125 South 2d St. Philadelphia
CATALOGUES ON APPLICATION
Send Business Card and Mention ELECTRICAL REVIEW.

Able Engineers
Now Specify
Cast Iron
Flange Pipe
And Fittings, for
Steam and Water
For special information and prices, write to
The Addyston Pipe & Steel Co.
Cincinnati, O.

THE CORRESPONDENCE
SCHOOL OF TECHNOLOGY,
CUYAHOGA BLD'G CLEVELAND, O.
Instruction by mail in Engineering Branches.
CAT. FREE. NOTE INSTRUCTORS.

THE LEHIGH VALLEY
CREOSOTING CO.
WORKS, PERTH AMBOY, N. J.
Office, Rooms 136 and 137, 1 Broadway, NEW YORK.
Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

Buyer of Second-Hand Machinery
SMALL ENGINES, LATHES, DRILLS, ETC.
Correspondence Solicited
WALLACE H. MANSFIELD
NEW HAVEN, CONN.

STYLE "F."

PIVOTED ARMATURE.
Send for Catalogue.
BELLS, PUSH BUTTONS, Etc.,
HUEBEL & MANGER,
286-290 Graham St., BROOKLYN, N. Y.

MESCO DRY BATTERY.
A standard battery for all open circuit or intermittent work. Highly recommended for Telephone Transmitters.
OVER 230,000 SOLD DURING THE PAST YEAR.
For sale by nearly all the Electrical Supply Houses in the United States.
GIVE IT A SEVERE TEST. Unreliable Dry Batteries are not sold much cheaper than the MESCO.
64-PAGE PAMPHLET FREE. Catalogue, 208 pages, 10 cts.
MANHATTAN ELECTRICAL SUPPLY CO.,
32 Cortlandt Street, New York.

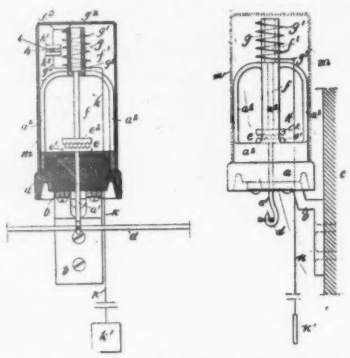
WEATHER-PROOF
TRADE MARK
"O.K."
LINE AND HOUSE WIRES
AGENCIES:
ELECTRIC APPLIANCE CO., CHICAGO, ILL.
PETTINGELL-ANDREWS CO., BOSTON, MASS.
ELECTRICAL ENGINEERING CO. MINNEAPOLIS, MINN.
ST. LOUIS ELECT'L SUPPLY CO. ST. LOUIS, MO.
BRADFORD BELTING CO., CINCINNATI, O.
PHILLIPS INSULATED WIRE CO.,
NEW YORK OFFICE: 39 & 41 Cortlandt Street.
FACTORY: PAWTUCKET, R. I.

STUDY ELECTRICITY AT HOME
by our unequaled correspondence method. Thorough instruction in applied electricity by competent engineers. APPARATUS FURNISHED without extra expense. Special proposition now open.
The Scientific Machinist Co., 53-54 Blackstone Building, Cleveland, O.

ELECTRICAL PATENTS

ISSUED JANUARY 28, 1896.

553,528 Lightning arrester; E. G. Hoffmann, Charlottenburg, Germany.—Comprises primary and secondary arrester devices in circuit between the conductor and the earth and a solenoid magnet interposed in circuit with the two arrester devices and controlling the arc of the primary arrester device, the secondary arrester having a fusible body interposed between its opposing plates or portions to facilitate the passage of the electrical discharge.



No. 553,528.—LIGHTNING ARRESTER.

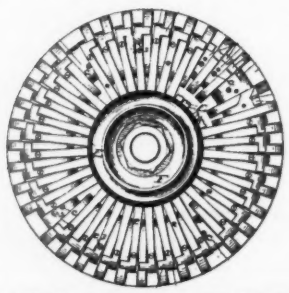
553,529 Method of electrical propulsion for street cars; J. Jackson, Clinton, Iowa.—Consists of a main-line conductor, an insulating housing having a movable section and a movable contact piece, consisting of a lever provided at one end with a contact piece adapted to engage the main conductor and connected by means of a line with the movable section of the insulating housing.

553,535 Telegraph repeater; Benj. F. Merritt, Newark, N. J.

553,538 Rheostat; W. H. Morgan, Alliance, Ohio.—Consists of a base, a resistance medium carried thereby and a series of metal plates partly embedded in said resistance medium, a movable contact carried by the base and adapted to engage the plates.

553,552 Electric railway conduit; A. Beck, Atlanta, Ga.

553,557 Armature for electric machines; R. M. Gardner, Chicago, Ill.—Consists of a series of coils, each of which has its inner end turned laterally to project from beneath the coil, and both this projection and its outer end freed from the insulation, and a series of commutator segments, each of which has a projecting arm, a portion of which extends to and is tightly clamped upon the inner end of one coil and another portion extends to and is tightly clamped upon the outer end of the adjacent coil.



No. 553,557.—ARMATURE FOR ELECTRIC MACHINES.

553,572 Dental light and heater; F. H. Stafford, Chicago, Ill.

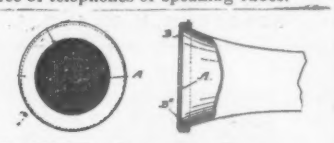
553,593 Manufacture of vanillin; M. Otto, Courbevoie, France.—Consists in subjecting a solution of iso-eugenate of soda or other base to electrolysis and then treating by means of an acid.

553,596 Secondary battery; P. F. Ribbe, Berlin, Germany.—A double electrode composed of two plates of non-conducting material held together by an acid-resisting substance between them, which plates have curved recesses for receiving the active mass.

553,605 Composite telegraphic and telephonic transmission; E. E. Backus, New York, N. Y.

553,632 Automatic coal-recording system for railways; F. A. Walters, Denver, Colo.

553,633 Antiseptic diaphragm for telephones; E. Weschcke, San Francisco, Cal.—A diaphragm saturated with an antiseptic ingredient cut into disks and a cap or holder, consisting of a rim, annular opening and a ledge or flange adapted to receive and hold the said disk in position over the mouthpiece of telephones or speaking tubes.



No. 553,633.—ANTISEPTIC DIAPHRAGM FOR TELEPHONES.

553,635 Underground trolley system; N. H. Anspach, Chicago, Ill.

553,637 Electric arc lamp; E. J. Bagnall, Cleveland, Ohio.—Consists of separating magnet and carbons of an arc lamp, arc-starting devices constructed and arranged to retard the formation of a normal arc after the carbons have begun to separate.

553,673 Incandescent lamp; H. Green, Hartf rd, Ct.

553,675 Electro-magnet; C. D. Haskins, Brooklyn, N. Y.—An electro-magnet with two insulated conductors in concentric sections or helices, each conductor including an inner and outer section or helix.

553,697 Electric arc lamp; H. O. Swoboda, New York, N. Y.—Consists of a movable frame, a brake and brake wheel carried by said movable frame, a rock shaft provided with an arm also carried by said frame, a stop for coacting with said arm and an adjustable weight or weights secured to the movable frame.

553,719 Electric battery; J. W. Olan, New York, N. Y.—A liquid negative pole in combination with a depolarizer located within said pole.

553,730 Electric switch; J. C. Fagan, Watertown, N. Y.

553,732 Electrolytic bath and appliance; J. H. George, New York, N. Y.

553,799 Electric railway; M. L. Wood, United States Navy.

553,819 Control system for electric motors; G. Sautter, Paris, France.

"HISTORY OF CRIPPLE CREEK."

We have just issued in book form the only authentic and reliable history of Cripple Creek gold camp, the marvel of the mining world. The book contains numerous full-page illustrations of gold mines true to life. With the sole object of introducing our big 8-page 56-column illustrated weekly paper (established 1890) we will send a copy of the above interesting book free to all who send us 25c. (stamps or silver) for a 3 months' (13 weeks) trial subscription to our big weekly, which contains the latest mining news and illustrations of Rocky mountain scenery. Club of 5 and 5 books $1. Mention THE ELECTRICAL REVIEW and address, *Illustrated Weekly*, Denver, Colorado.

DYER & DRISCOLL,
Patent Solicitors, 36 Wall Street, N. Y.

have done all my patent soliciting work, both for this and foreign countries, continuously for the past fourteen years.

Thomas A. Edison

PATENTS.
TRADE MARKS.—DESIGNS.—COPYRIGHTS.

CAN YOU OBTAIN A PATENT?

Send me a model or drawing of your invention, and a description, and I will examine same and advise you promptly. My fees are moderate in all Patent matters, and I can obtain a Patent in the shortest possible time.

All Patents taken out through me are given special notice in the leading journals of the country, thus bringing same widely before the public without cost to inventor.

REFERENCES: "Electrical Review," New York: Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works, Olympia, Oregon.

EDW. S. DUVALL, JR., Loan and Trust Bldg,
Solicitor of Patents. WASHINGTON, D. C.

PATENTS

ROBT. H. READ,
SUCCESSOR TO
POPE, READ & ROGERS,
41 CORTLANDT ST., NEW YORK CITY.

Electrical Inventions a Specialty.

WHITE-CROSBY COMPANY,
CONTRACTING ENGINEERS,
EQUITABLE BUILDING, BALTIMORE, MD.
New York Office, 29 Broadway.

W. R. OSTRANDER & CO.
No. 204 FULTON ST., NEW YORK.
Manufacturers of
SPEAKING TUBES, WHISTLES, ANNUNCIATORS,
Electric and Mechanical Bells.
FACTORY,
De Kalb Ave.,
BROOKLYN.
Send for Illustrated Catalogue.

STEAM ENGINEERING
(Stationary, Marine and Locomotive), Electricity, Architectural and Mechanical Drawing, Plumbing, Heating, Mining, English Branches, etc.,
TAUGHT BY MAIL.
Engineers can qualify to obtain licenses. To enroll only necessary to know how to read & write. Circular free. State subject you wish to study.
The International Correspondence Schools,
SCRANTON, PA.

Latest, Best, Quick, Strong, Wears Long, Writes Well, Never Fails, Simply Made,

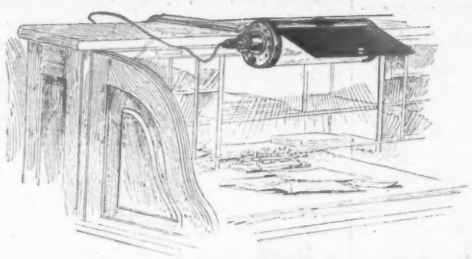
THE NEW MODEL **6**

THE **REMINGTON** Standard Typewriter

Therefore Leads.

Catalogues sent by WYCKOFF, SEAMANS & BENEDICT, 327 Broadway, New York.

SAVE YOUR EYES BY USING



THE KINSMAN DESK LIGHTS AND PORTABLES.

AGENTS:
Thos. Day & Co., San Francisco, Cal.
The Central Electric Co., Chicago, Ill.
W. H. Glenny, Sons & Co., Buffalo, N. Y.
McKenney & Waterbury, Boston, Mass.

MANUFACTURED BY
McLEOD, WARD & CO., THAMES BLDG., **NEW YORK.**

THE

Telephone Hand-Book.

BY HERBERT LAWS WEBB.

146 PAGES. 138 ILLUSTRATIONS.

CONTENTS:

Chapter 1. The Invention of the Telephone.—Chapter 2. Sound Waves, Articulate Speech.—Chapter 3. Electric Telephony. The Bell Telephone.—Chapter 4. The Microphone.—Chapter 5. Current Induction. Electro-Magnetic Induction.—Chapter 6. The Induction Coil: Its Use in the Telephone Transmitter.—Chapter 7. The Complete Telephone Circuit.—Chapter 8. Magnet Telephones.—Chapter 9. The Bell Telephone Receiver.—Chapter 10. Other Forms of Magnet Telephones.—Chapter 11. The Gower, Ader and D'Arsonval Receivers: Mercadier's Bi-telephone.—Chapter 12. The Siemens, Kotyra, Neumayer and Bottcher Receivers.—Chapter 13. Carbon Transmitters.—Chapter 14. The Blake Transmitter.—Chapter 15. The Long-Distance Transmitter.—Chapter 16. The Solid Back Transmitter.—Chapter 17. The Berliner Transmitter.—Chapter 18. The Cuttriss Transmitter.—Chapter 19. Various European Transmitters.—Chapter 20. The Efficiency of Carbon Transmitters.—Chapter 21. Batteries for Telephone Work.—Chapter 22. Open Circuit Batteries.—Chapter 23. Closed Circuit Batteries.—Chapter 24. The Practical Management of Batteries.—Chapter 25. Magneto Bells.—Chapter 26. Automatic Switches.—Chapter 27. Telephone Line Construction.—Chapter 28. Metallic Circuits.—Chapter 29. Underground Wires.—Chapter 30. Lightning Arresters.—Chapter 31. Inside Wiring.—Chapter 32. Installation of Telephone Instruments.—Chapter 33. Inspection and Maintenance.—Chapter 34. The Condenser: Its Use in Telephony.—Chapter 35. Electro-Magnetic Retardation.—Chapter 36. Exchange Working.—Chapter 37. Small Exchanges.—Chapter 38. Party Lines: The Bridging Bell.—Chapter 39. Long Distance Telephony.—Chapter 40. Duplex Telephony.—Chapter 41. Simultaneous Telegraphy and Telephony.—Appendix.

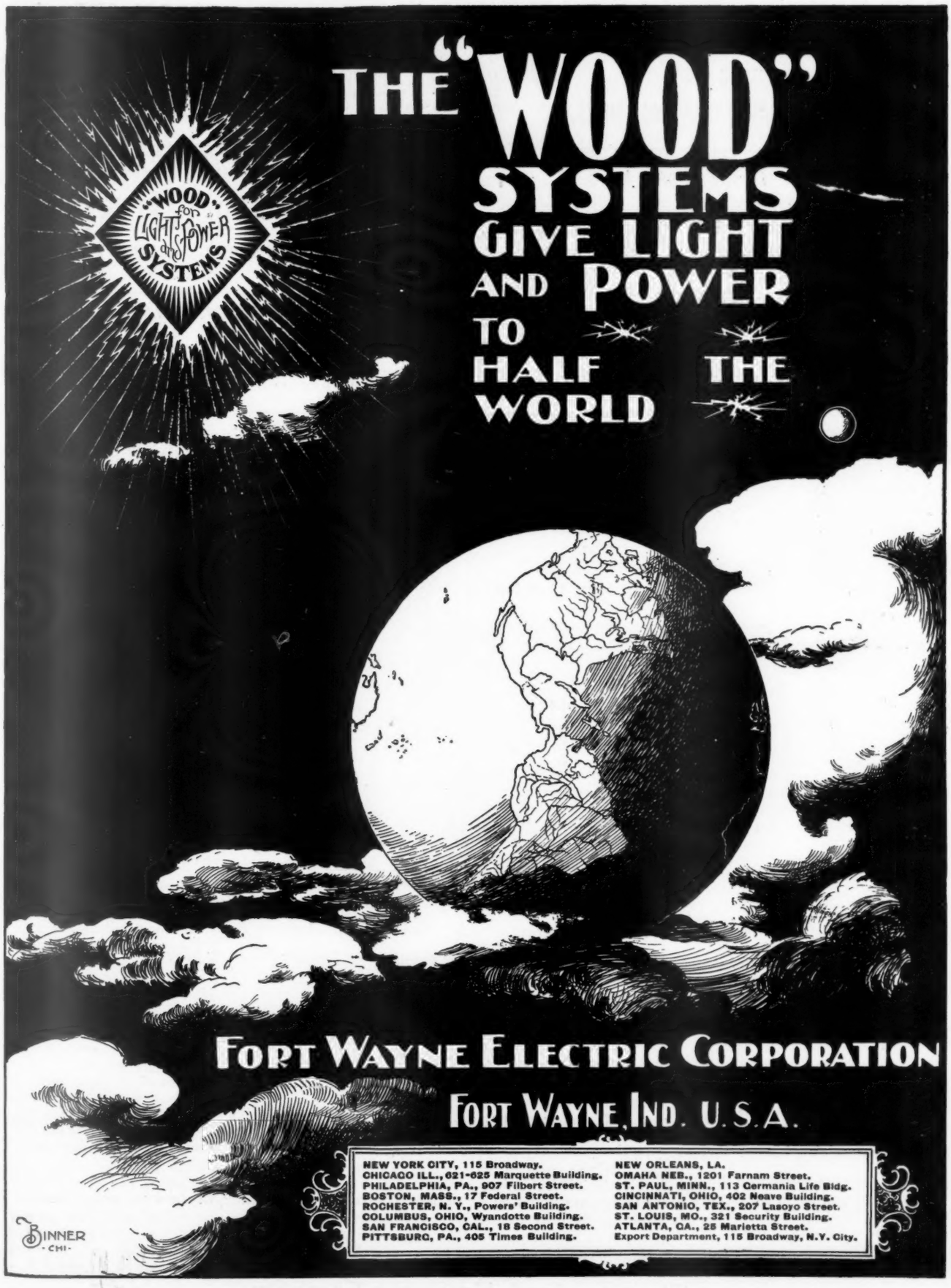
A PRACTICAL UP-TO-DATE BOOK. A TIMELY WORK.

Price, $1.00. Postpaid.

SEND YOUR ORDERS TO

ELECTRICAL REVIEW PUBLISHING COMPANY,

13 PARK ROW, NEW YORK.

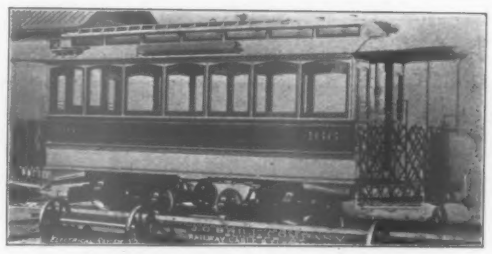

"WOOD" for LIGHT and POWER SYSTEMS
THE "WOOD" SYSTEMS GIVE LIGHT AND POWER TO HALF THE WORLD
FORT WAYNE ELECTRIC CORPORATION
FORT WAYNE, IND. U.S.A.
NEW YORK CITY, 115 Broadway.
CHICAGO ILL., 621-625 Marquette Building.
PHILADELPHIA, PA., 907 Filbert Street.
BOSTON, MASS., 17 Federal Street.
ROCHESTER, N. Y., Powers' Building.
COLUMBUS, OHIO, Wyandotte Building.
SAN FRANCISCO, CAL., 18 Second Street.
PITTSBURG, PA., 405 Times Building.
NEW ORLEANS, LA.
OMAHA NEB., 1201 Farnam Street.
ST. PAUL, MINN., 113 Germania Life Bldg.
CINCINNATI, OHIO, 402 Neave Building.
SAN ANTONIO, TEX., 207 Lasoyo Street.
ST. LOUIS, MO., 321 Security Building.
ATLANTA, GA., 25 Marietta Street.
Export Department, 115 Broadway, N.Y. City.
BINNER CHI

J. G. BRILL COMPANY,

Philadelphia,

BUILDERS OF

ELECTRIC, CABLE, SUBURBAN CARS AND TRUCKS.



INVENTORS and BUILDERS OF
BRILL No. 21 B and
EUREKA MAXIMUM TRACTION TRUCKS
FOR
ELECTRIC CARS.

Received the Only Medals of Award for Rubber-Covered

INSULATED WIRES

AERIAL, UNDERGROUND, SUBMARINE AND INTERIOR USE.

KERITE TAPE.

Catalogues, Samples and Prices on Application.

S. F. B. MORSE - - - Chicago, Ill.
CALIFORNIA ELECTRIC WORKS, San Francisco, Cal.

DAYS KERITE

Wires and Cables at the WORLD'S FAIR at Chicago.

AND CABLES;

TELEPHONE, TELEGRAPH, POWER AND LIGHTING.

W. R. BRIXEY, Manufacturer,
J. E. HAM, General Agent,
203 Broadway, NEW YORK.

SPECIAL ATTENTION GIVEN LEAD-ENCASING WIRES AND CABLES.

No. 7707
IRON BOX BELL.

Ask your Dealer for the
No. 7707 Iron Box Bell.

H. E. & C. BAXTER,

MANUFACTURERS OF

ELECTRICAL SUPPLIES,

BEDFORD, DIVISION AND CANTON STREETS,
BROOKLYN, N. Y

WESTON Electrical Instrument Co.,

114-120 William St., NEWARK, N. J., U. S. A.

Weston Arc Light Ammeter.

The Weston Arc Light Ammeter

is cheap, but nevertheless reliable and very accurate.

The scale is so proportioned that a change of $\frac{1}{10}$ of one ampere can be seen from a considerable distance. The instrument is absolutely "dead beat." Three different ranges are being made:

No. 1.	5.8	6.8	7.8	amperes in	$\frac{1}{10}$	ampere	div.
No. 2.	8.6	9.6	10.6	"	" $\frac{1}{10}$	"	"
No. 3.	9.5	10.5	11.5	"	" $\frac{1}{10}$	"	"

Mention the ELECTRICAL REVIEW when writing for catalogues.

"ONE MORE UNFORTUNATE!"

One of our men recently equipped some cars on a certain road with "Standard" Air-Brakes. He was transferred (with others) to the Brill Company's shops in Philadelphia to equip with "Standard" Air-Brakes a lot of cars they built.

While he was working there, it was the writer's misfortune to have to send him the following telegram:

"W. E. CRIST,
Foreman Standard Air-Brake Co.,
C/o J. G. BRILL CO.,
Philadelphia, Pa.

Send Emmanuel Magnussen home immediately. His son is in hospital. Will probably die. Run over by trolley car."

Isn't there something *unusually* sad about this? It's harrowing to realize that while the father was putting air-brakes on cars in a distant city, his son was lying at the point of death, after having had one limb dismembered by the trolley car. That poor lad's parents will believe more than ever in Air-Brakes.

Don't you think it's about time to bring cars under more perfect control? We've thought so ever since electric cars became the order of the day.

We'll help solve the braking problem if you'll let us.

The Standard Air-Brake Company,

E. J. WESSELS, General Manager,

100 BROADWAY, NEW YORK.